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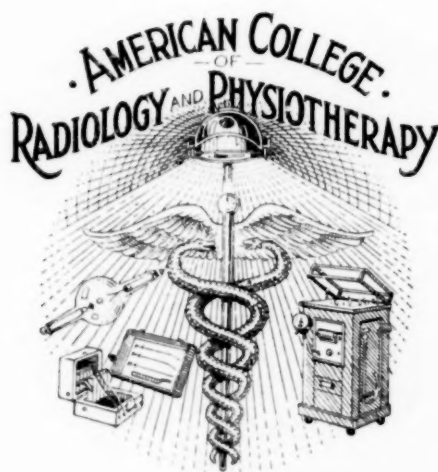
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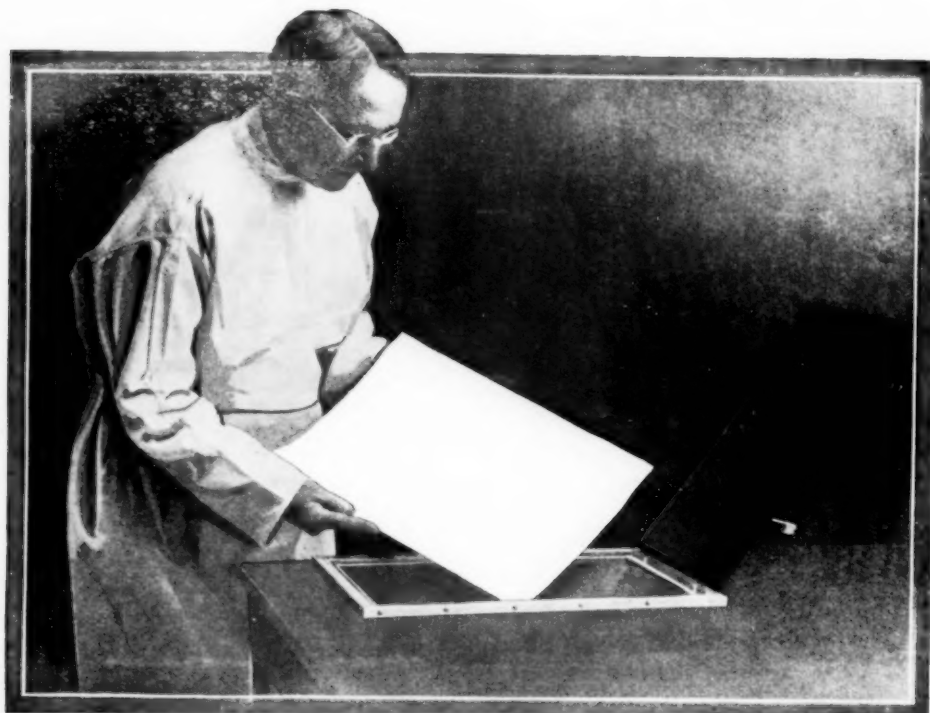
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Heliotherapy in the Treatment of Extra Pulmonary Tuberculosis*

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Denver, Colorado.

LIGHT therapy, both natural and artificial, has, within recent years, assumed a position of such importance in the treatment of certain diseases that it can no longer be regarded as an experimental study in the hands of a few, but must become the knowledge of every physician who would give his patients the best in therapeutics. True, we must go slowly, remembering that theories are only theories, and that clinical results of sufficient duration to be called cures are the only real and safe guides to the efficacy of any form of treatment. This, now, we feel that we can say of heliotherapy in the treatment of certain forms of extra pulmonary tuberculosis.

As early as the times of the Greeks and Romans, solaria were built in the homes, and Hippocrates mentions the value of sunlight as a therapeutic agent, but not until the French, about 1800, began to make accurate and scientific observations of the effects of sunlight in the treatment of tuberculous conditions do we have our attention directed to this potent force for the treatment of human ills. In 1899 Finsen first demonstrated the value of ultraviolet rays in lupus and the effects of the red rays in smallpox. A few years later, in 1902, Bernhard of St. Moritz, treated suppurating wounds with marked benefits with sunlight, and a year later Rollier of Leysin, Switzerland, opened his now famous sanatorium for the treatment of extra-pulmonary tuberculosis. So uniformly successful has sunlight treatment been, particu-

larly in children, in the cure of bone, joint and glandular tuberculosis, that it has had numerous exponents in Europe, particularly in Germany, France, and England. This country has been exceedingly slow in adopting this form of treatment; except for a few scattered institutions, of which the J. N. Adams Memorial Hospital at Perrysburg, N. Y., and the Heliotherapy Ward at Fitzsimons Hospital in Denver may be mentioned, there are few hospitals or sanatoria routinely treating their cases of extra-pulmonary tuberculosis with sunlight. Perhaps it is well that we have been hesitant in accepting what is such a radical departure from the accepted forms of treatment, especially in tuberculosis, where the quack and charlatan have found such a fertile field, and in which condition the unfortunate victim is too ready to grasp at any straw which to him may offer any ray of hope. But we can say today, without any hesitation or reservation, that tuberculosis of the bones and joints, the skin, the glands, and the genital system are curable as any other curable disease, unless treatment is begun in the terminal stages. Particularly is this true in children. It is high time that this was recognized generally by the profession, and by state, county and municipal institutions for the care and treatment of the tuberculous, or else we are in danger of having the public initiate this form of treatment in isolated cases with their imperfect, inadequate knowledge gained from popular magazine and newspaper articles, which are already appearing, and in such a way and with necessarily indifferent results, that light therapy will fall into disrepute even before the profession have become

familiar with it. Certainly every physician who treats the tuberculous, and most of us do at one time or another, should know the methods of use and the results obtained by this form of treatment. It is with this object in view that I am glad to have the opportunity to tell you what we have done and are doing with heliotherapy in the treatment of extra-pulmonary tuberculosis at our hospital in Denver.

Before telling you of the clinical therapeutic aspects of heliotherapy, it might be well to discuss briefly what little we know of the properties of the radiant energy of the sun's rays, how they are modified before reaching the patient, and what action they have on living tissue. The rays radiated by the sun are grouped, for convenience, into two main classes, those forming the visible and those forming the invisible spectrum. Many of these we have been able to identify, but, when we consider the gaps in the invisible spectrum and the unexplored region between it and the x ray and radium, we must admit that there are in all probability many rays from the sun which we know nothing about and which may have profound physiologic and therapeutic effects. All of the rays are capable of heat production, light production, and chemical activity. Whether therapeutic results are obtained through vasodilation and deep action of the better penetrating red rays, or through the chemical action (local or distant) of the actinic rays, or, what may be the case, the combined action of all, it is impossible at present to say. Each end of the spectrum has its advocates, and although the actinic rays have been receiving the greater credit, it must be remembered that sunlight

*Read at X Ray and Phy. io:therapy meeting, Omaha, Sept. 2, 1924. Published by permission of the Surgeon General, U. S. A.

possesses not nearly so many short rays as the lamps especially designed for their production, particularly at low levels where extremes of moisture and dust disperse them, yet the therapeutic results have been favorable.

Altitude has been considered a valuable adjunct in the utilization of sunlight for therapeutic purposes, principally because of its atmosphere of greater purity, the absence of moisture, and its lessened distance from the source, thus eliminating the absorption and diversion of the rays, particularly those of shorter wave lengths, which have been considered of greatest potentiality. It has been estimated that from 50 to 60 per cent of the ultraviolet rays are lost to the lowlands and from 20 to 30 per cent of the red rays are lost, but the sun loses 6 per cent of its intensity at Mt. Blanc and 20 per cent at sea level. Lowlands, therefore, have been considered unfavorable, particularly those inland where the atmosphere is rich in moisture and full of smoke. Snow and water, by some, are considered excellent intensifiers, because of their marked reflecting powers, the snow being more beneficial than water, there being less absorption. Clinical results, however, have not wholly substantiated these theories, for excellent cures have been obtained at Perysburg, N. Y., as well as at Denver, and at Hohenlychen in Berlin, as well as at Leysin in Switzerland.

The question of pigmentation of the skin after exposure to natural or artificial light has been the subject of much speculation. The physiology of its formation does not concern us, but what rays stimulate its production, what wave lengths and to what extent they are able to penetrate it, which ones are absorbed or reflected by it, (or as Rollier believes, it has the power to transform the short ultraviolet rays to longer ones, thus increasing their powers of penetration), might be of great value in aiding us to select the proper rays for various uses. Balderry and Ewald state that the penetrating powers of solar radiation is increased by pigmentation. At any rate, the question of pigmentation has been a rather important one, some even feeling that clinical progress and prognosis could be estimated by the rapidity and degree of pigmentation. But here again clinical findings seem to refute theoretical ex-

pectations; it has been our experience that blondes who pigment very slowly and even after several years of exposure, very slightly, have progressed clinically in every respect as well as the deeply tanning brunettes. Practically every individual has his own tanning rate and degree, from a light brownish yellow to a negroid color, but we have been unable to connect this in any way with clinical progress.

The seasons of the year, in almost every locality, have an important bearing upon the practical application of sunlight. There are many cloudy days during rainy seasons, and in very cold, windy weather, the patient can not stand exposure. It is also held by some that the sun's spectrum during the winter months differs from that during the summer. Jungling contends that the shortest rays at noon are 120 Angstrom units shorter in July than those in the same altitude in January, and that there is a seasonal variation in intensity of solar radiation. But for therapeutic purposes the difference in density has not been shown to be an important one. In Denver, where we have altitude and a predominance of sunshine, these differences are of secondary importance and the missing of a day or two of treatment occasionally is of no great moment, and it must also be remembered that even on cloudy days a certain percentage of the sun's rays, directly or by reflection, reach the patient.

In the summer time it is our policy to have the patients take their sun as early in the morning as possible; some begin at sunrise, in order that they may be able to get their total time in without being affected by the extreme heat. They get sufficient exposure without danger of the depressing effects from the longer rays. In the winter time we have them take treatment around noon to get the benefit of the maximum intensity and the warmth of the heat rays.

As sunlight contains all of the different kinds of rays that we are able to produce artificially except x rays and radium, for practical purposes, it must be accepted that any action that can be produced can be obtained by the use of sunlight. That we do get results, and get them very definitely, there can be no doubt; but how we get them is still largely an unanswered question. We will confine ourselves to stating only the effects

which have been demonstrated as being solely the results of the action of light rays.

Light rays from the sun are bactericidal, varying of course with different intensities and different organisms; the blue end of the spectrum is probably more active and is itself intensified by the presence of the heat producing rays.

Balderry and Ewald have demonstrated that rays from the sun are able to penetrate human tissue to a depth of ten inches; these, of course, are the longer rays. The blue and yellow rays penetrate a distance of from one to three inches, while the ultraviolets are able to penetrate only one millimeter.

Sunlight rays cause definite hyperaemia of the skin; an immediate hyperaemia is produced by the longer rays and a delayed hyperaemia is produced by the shorter rays. The immediate hyperaemia passes off about an hour following exposure, while the delayed hyperaemia is followed in a few days by the definite formation of pigment. Over-exposure to the shorter rays causes tissue destruction. Soon the skin becomes softer, it feels velvety, superficial skin infection disappears, the hairs of the skin grow longer, and the sebaceous and sweat glands pour forth their secretions in abundance. There is a dilatation of the superficial and deep skin vessels, the epidermis becomes loosened and vacuolated; there is a marked division of the nuclei of the epithelial cells and a dilatation of the lymph spaces.

Of the general effects upon the system produced by exposure to sunlight, there are many theories but few capable of definite demonstration. There is an increase in the total red cells and an increase in the haemoglobin content of the blood. Some observers have reported an increase in leucocytes and, after tanning, an increase in the lymphocytes, but these findings have not been constant. Recently Mayer and others have shown that there is a definite increase in the calcium and phosphorus content of the blood and an increased alkalinity. It has been suggested that certain tissues may have an affinity for, and be affected by, certain wave lengths, and that they may be permeable to some and refractive to others. This would be of great practical use if we have definite knowledge on this subject, but it is, so far, only speculation.

That there is undoubtedly a better general metabolism following heliotherapy, there can be no doubt. Any one who has had the opportunity of contrasting the pale, anaemic, wasted patient, with his loss of subcutaneous tissues and flabby musculature, who has been treated indoors for prolonged periods, particularly if suffering from tuberculosis, with the patient who has been treated out of doors with sunlight and who has wonderful color, firm tissues, muscles even larger than when treatment was started, who feels well and who looks well, must be convinced that a powerful factor has been active in bringing about this striking change for the better.

Regardless of where we have demonstrated the pathology, radiation is always given generally. The fundamental conception of tuberculosis is that it is a general systemic disease and that any therapy to be efficacious must be general. Treating the local area in tuberculosis is like treating a single lesion in smallpox. The local lesions that we see, as an infected ankle, or knee, or a cervical gland, are local manifestations of the general disease, and while they are not to be overlooked in treatment, they are given the attention they require, and no more. Treatment of them alone will not cure the disease, but the cure of the disease and the local manifestation will be taken care of at the same time.

Treatment is begun gradually, following the method of Rollier. The feet and ankles are exposed five minutes anteriorly and five minutes posteriorly the first day. The second day, exposure is made half way up to the knees for an additional five minutes front and back, and so on, increasing the area to be exposed approximately the same each day, thus increasing the total time ten minutes daily until the entire body is exposed except the head. In the summer, a total of two hours is reached and in the winter three hours. This will vary slightly in different localities. Patients are encouraged to get their sun as early in the morning as possible and are not allowed to sun until a half hour after meals.

They wear very little clothing; this is regulated somewhat by the weather, but for the most part a pair of trunks constitutes their covering. This is a very important part of the

treatment and some observers believe it may even be the most important part in the treatment of tuberculosis. The stimulating effects of the air baths are but imperfectly understood, but that they do stimulate the skin and indirectly the vasomotor system is reasonable to believe. Circulating air is considered better than still air. Girdlestone, of Oxford, believes that the wind is the most beneficial of all. We have noticed that patients soon become more quiet, they sleep better, and are less nervous and irritable soon after they are out of doors all of the time. Their appetites are better and they feel better generally. Their bodies are having the opportunity of functioning physiologically under conditions of nature such as they have never had before.

GLANDULAR TUBERCULOSIS

This manifestation of tuberculosis, although most commonly found in children, is met with also in adults. Everywhere that it has been treated by heliotherapy the results have been equally satisfactory. Regardless of the extent of involvement or the location of the lesion, they quickly resolve under continuous treatment. If the involvement has been slight, and the glands are only slightly enlarged, they disappear gradually, leaving no evidence of their former presence. If considerably enlarged, they usually break down under the skin and are slowly absorbed, or, as we treat them, they are aspirated until they no longer contain free pus, after which only a small amount of fibrous tissue is left. Aspiration is the preferable method of treatment, as healing takes place more rapidly. If the involvement has been so extensive and advanced that the skin has become involved and there is breaking through and open suppuration, the open sinuses are treated daily with one of the photodynamic dyes before exposure to the sunlight. Under this treatment there is a rapid healing and a resulting skin and subcutaneous tissue which is relatively free from adherence and an almost imperceptible amount of scar tissue. It is surprising how little evidence there is left even after extensive disease. One of our cases presented himself for treatment with the left anterior cervical glands enlarged to the size of an orange, there was marked restriction of head movement due to tension and several sinuses were discharging freely. After four months of treat-

ment the sinuses had closed and the swelling decreased to almost a quarter of its original size, the patient's general condition improving as well. After six months, the lesion had entirely healed with very little scarring and no functional deficiency, and the skin was almost entirely free from the deeper structures. This man had had several operations on this same set of glands previous to his admission to our hospital, each followed by scarring and subsequent recurrence. A year after his heliotherapy treatment he is free from recurrence. We believe that the general improvement in this case with the resulting building up of the immunity has placed this patient in such a condition that he will be free from further local manifestations of tuberculosis.

BONE AND JOINT TUBERCULOSIS

We will consider bone and joint tuberculosis together, as the bone is nearly always involved distally to the epiphysis and treatment is the same in both conditions. The question of complete or partial immobilization in this type of case is still an open one and certain cases may require one kind of treatment and others the other, each has its advocates. We use the partial, believing that with the aid of the general improvement brought about by heliotherapy, healing is sufficiently rapid and that the resulting joint will be of more functional value than if complete immobilization is continued over the necessarily long time required for healing. In other words, our aim is to get a functioning joint. We use plaster troughs instead of plaster casts or mechanical immobilization apparatus, and in none of our cases have we considered destructive or immobilization operations necessary. The use of troughs give good immobilization; they are made form-fitting for each case, thus eliminating pressure sores and also allow radiation of the affected parts as well as the tissues above and below, which would otherwise be covered. In knee and hip involvement, where there is more or less contracture due to muscle spasm, we apply extension, enough to counteract this muscle pull and to keep the joint surfaces separated. This, too, aids in immobilization. Of course, weight bearing is never allowed on an infected joint. Upper extremity involvement is treated in the same manner except that

extension is not used, the weight of the parts below the lesion usually being sufficient to keep the surfaces separated. In any case the parts are held in such position that should ankylosis occur they would be most functionally useful. As soon as the active disease process has stopped and there is beginning healing, as evidenced principally by the x ray and to some extent by the symptoms, passive motion is begun. Symptoms alone are not safe guides, as all pain usually disappears early and swelling and fluctuation disappear before healing has progressed to any extent. Movement must be begun cautiously, very gently and slowly at first, and close attention must be paid to any local or general reaction. Nutritional massage is instituted as soon as the patient can bear it without discomfort of the parts above and below the affected joint. The range of movement is gradually increased. After several months, and with frequent checking by x rays, partial weight bearing is begun. This, too, is carried out with great caution and very slow increase. Months, not days, must elapse before total weight bearing is permitted, and due regard for the amount of involvement and destruction must be made. We cannot hope to get perfect results in all cases, particularly in adults, but any movement is better than ankylosis. This we have been able to secure in our cases which have progressed to the stage where weight bearing has been permitted. One of our cases had extensive involvement of the ankle, with multiple discharging sinuses and swelling, and which formerly would have been considered an amputation case, in eight months was walking on his foot and has only a slight limitation of flexion and adduction. He walks without perceptible limp and for all practical purposes has a good functioning joint.

If there is cold abscess formation, these are aspirated, never allowed to rupture spontaneously or opened with a knife for this invites secondary infection, which is a serious complication and should never be allowed to occur. A cold abscess is a mechanical process—nature's effort to remove necrotic tissue—and is not destructive in itself except through pressure when large, whereas when mixed infection occurs the process becomes an actively destructive one and always accompanied by general

reaction. These cold abscesses should be aspirated through healthy tissue and from a point above the abscess, so that there will be no tendency for a sinus tract to form by gravity drainage along the needle tract. Aspiration should be done as often as necessary to keep the abscess empty, every day may be necessary if the abscess is a large one. If the case presents discharging sinuses when first seen and they are superficial, as in the knee, ankle, or elbow, and are present, they should be removed, after which they usually heal quickly; the bactericidal action of the sun's rays sterilizes them and stimulates healing. The application of photodynamic dyes hastens this sterilization and healing. If the abscesses are deep, however, and mixed-infection, draining sinuses are present, the problem is a difficult one. These tracts are rarely of uniform size throughout, or straight, but are exceedingly tortuous, irregular and with multiple sacculations. Drainage is imperfect, and there is always more or less absorption with its resulting disturbance of the general system. Sooner or later, unless vigorously treated, these patients develop amyloid disease, which is usually fatal within a few years. We have several such cases in which, as far as we are able to determine, the tuberculous process in the bone has healed, and yet these patients are still seriously ill with large infected sinuses. These tracts must have adequate drainage, and the superficial opening must be enlarged to allow complete daily removal of all pus by mechanical irrigation. Gravity drainage is preferable and is used wherever possible. In this type of case, probably more than in any other, we have noticed the remarkable effects of heliotherapy. After months of continuous suppuration from extensive sinus tracts and where perfect drainage has been impossible, due to the multiple pocketing and tortuosity, these patients look well, they are well nourished, their appetites are good, and they sleep well; also we have been unable to demonstrate any disturbance of the liver, kidney or heart function. This is in marked contrast to this same type of case treated indoors and without sunlight therapy. We are treating one case with relatively short straight sinus tracts with ultraviolet radiation from a Kromayer water-cooled lamp

through quartz tubes inserted as far as possible into the sinuses after the irrigation of the tract with eosin, on the theory that the rays, after leaving the quartz rod cause the dye to fluoresce and become radiantly active and bactericidal. However, we have been using this method of treatment for only six weeks and have noticed no effects as yet.

SEROUS TUBERCULOSIS

The serous types of tuberculosis, such as peritonitis, simple tuberculous pleurisy, pericardial and synovial membrane involvement, respond particularly well to light therapy. This form of tuberculous involvement is probably easiest for the system to handle under any circumstances, but undoubtedly they progress much more favorably and quickly under heliotherapy.

GENITO-URINARY TUBERCULOSIS

To the vast majority of American physicians today, tuberculosis of the genito-urinary system is considered a surgical disease. Why it has been singled out as a distinct local process and why the general disease, of which it is only a local manifestation, is usually disregarded, is hard to understand. There can be no doubt that this wrong conception of the condition has been responsible for the very unsatisfactory end results of this form of treatment. Cures in tuberculosis should never be considered complete in a few days or weeks. A manifest active tuberculosis is never cured in such a short time, whether it be lung involvement or only a small lesion of the epididymis. It requires months for the systemic disturbance which we know as tuberculosis to be eradicated and for the resistance or the immunity to be brought up to the point where recurrence is no longer inevitable. Surgical treatment is impressive; the patient feels that if the local disease, all that he recognizes, is eradicated, and the quicker the better, he is cured, but we, as physicians, must no longer be deceived by such superficial results.

It is important that the patient be told that treatment, to be successful, must be carried on continuously for an extended period, from one to three years. This allows him to settle down, to get mental relaxation, as well as physical. He is not continuously looking for local improvement, and estimating his progress by the appearance of local lesions or the clear-

ing up of local symptoms. He learns that only the continued, slow, improvement in his general condition is the important thing, and is satisfied that progress, although not rapid, is sure, and that what the system has been able to heal is likely to keep healed. These patients are treated as bed patients, with bathroom privileges allowed. Rest, our greatest therapeutic agent in the treatment of tuberculosis, is given in this way. As all tuberculous cases, these patients are restless, and introspective. It is hard for them to relax. They do not feel ill generally and usually not very much so locally. The outdoor air, the soothing effect of the sun's rays, combined with the habit they soon get into of remaining in bed, soon banishes this restless irritability, and it is soon no longer a hardship to take this form of treatment; as a matter of fact, complaints are very rare.

A wholesome, well mixed nutritious diet is handled very well by these patients. No attempt has been made to treat any of our cases with special diets. At times it has seemed advisable to restrict the total intake, but this only in severe bilateral kidney cases. The bowels can be controlled, in obstinate cases, with plenty of water and mineral oil once or twice daily and the addition of cellulose foods for breakfast when necessary. Gastric disturbances give these cases very little trouble. It can be safely said that patients taking heliotherapy treatment are able to handle their foods much better than the average bed patient indoors, and for the most part as well as a well person who is up and about.

Because of the long continued confinement, and the necessity of occupying the time for these cases, we allow all kinds of light reading; radio outfits and light occupational therapy as given by our educational department, such as basket weaving, leather work, typewriting, and as progress continues, even various kinds of school work. As most of these cases feel well generally and are with many others taking the same treatment, hospitalization for them is not so much of confinement as it would be if each case were treated alone. For this reason, it is believed that these cases should be treated in institutions rather than at home.

We are giving all of our genito-urinary cases a five per cent calcium chloride solution intravenously every

five days, as we noticed a marked effect on relieving pain, particularly the severe bladder irritability which is the prominent symptom in many of the cases. We have been unable to attribute any healing effects on the lesions, however, following this treatment.

If abscesses appear, as in the scrotum, they are aspirated, and kept aspirated until they no longer fill with pus. A few aspirations are all that are usually necessary. If the lesions are already open, they heal readily on exposure to the sun and the application of one of the photodynamic dyes. This is the only local treatment that is employed.

The general effects of this form of treatment are, of course, the same as in the other forms of extra-pulmonary involvement. Locally the changes are essentially as follows: For the first few weeks there is no noticeable change, then gradually there is an apparent activation of all the local symptoms. Hardened indurated areas become softer, abscesses are formed, tenderness and pain are increased, and in areas where no lesions were demonstrable before treatment was started, lesions appear. There is a stirring up of the general system to a reaction where before it allowed the smouldering tuberculous process to slowly spread. It is getting ready to eliminate the diseased foci. The abscess is discharged, or is aspirated, or if the focus is a small one, it is evidently absorbed without going through the stage of pus formation. In this manner, the various foci are eliminated, and the tissues heal.

The same process goes on in any of the tissues which may be involved, while not apparent in the kidneys or prostate, to the extent that they are in the epididymi or seminal vesicles; recurrent pus in the urine, with casts and albumin, indicate that some such process has been going on in the kidney or prostate, causing at times the sudden arising or cessation of pain. As the disease is gradually being eradicated, these symptoms become fewer and, depending upon the extent and severity of involvement, soon disappear altogether.

In this method of healing there is a minimum of scar tissue formation, consequently loss of function is very slight, if any, and there is none of the mutilation which so often follows the treatment in the hands of too zealous surgeons.

CONCLUSIONS

That heliotherapy combined with outdoor treatment with its fresh air and air or wind baths is a powerful therapeutic agent for the building up within the system of the powers of resistance to disease and is definite, almost specific, in its action in extra-pulmonary tuberculosis, cannot be denied by any who have had the opportunity of treating cases by this method. It is not a panacea, but its proper use in judiciously selected cases offers more than any other form of treatment. Care must be exercised in its administration, it is a powerful therapeutic agent when properly used, but can cause considerable local destruction and general reaction if not properly regulated. The same painstaking care must be exercised in its use as with any other form of radiation. This is more difficult to do because the patient, to a large extent, administers the treatment to himself, unlike other forms of radiation in which it is done for him. Many of them feel that if a little sunlight is good, more will be better, and particularly at the beginning of treatment careful supervision is necessary in order that over-exposure is not taken and damage done. There is a proper way of taking sun treatment and this must be explained in detail, for only with the coöperation of the patient can we hope for any degree of success.

Again I want to impress upon you the importance of having the proper conception of tuberculosis, whether it be of the lungs or of the joints, glands, or bladder. It is a general disease and only by general treatment can we hope to effect its cure. Local measures may give local relief, but only general treatment can result in lasting cures.

DISCUSSION

Dr. T. J. Kerr (North Platte, Nebr.): I would like to ask what percentage of calcium chloride solution he uses?

Major Myll: A five per cent aqueous solution of calcium chloride—five c.c. intravenously every five days.

Dr. E. C. Henry (Omaha, Nebr.): About a year ago a man passed through here carrying the news that in tubercular conditions the lime salts were decreased in the blood stream, and not only in tuberculosis, but in chronic conditions such as ulcers. We immediately set our chemist to work on the problem and never could verify it.

Since studying this subject, we have come to look upon the blood as a very greedy tissue, and as long as there is any lime anywhere in the system, it will be found in the blood stream. The same is true for sugar. As long as there is sugar in the liver, there will be a certain percentage in the blood stream.

I would like to have the Doctor tell us how he determines the lack of lime in the blood stream. We fell down on it. I want light.

Dr. R. W. Fouts (Omaha, Nebr.): I think perhaps there are some of you who have not had opportunity to observe some of the things the Major has mentioned in his paper, and may be under the impression that it sounds a little unusual or perhaps exaggerated. It was my privilege to visit his hospital last February—the Fitzsimons General Hospital, at Denver—and to observe some of the things of which he told you. It was a revelation to me to see patients with miliary tuberculosis and Potts' disease receiving nothing but heliotherapy. I think he told us if he had too much cloudy weather it was substituted by actinic therapy. It was a revelation to see their contented state of mind. Some of them had been lying for perhaps a year or longer. They were well nourished, with muscles that would do credit to a laboring man. They did not appear anemic, and were getting well. We saw them in all stages of the disease.

It was the first opportunity I had had to see first-hand a thing of this kind, and it was surprising almost beyond any expectations I may have had. I know of no place they have yet had the opportunity of using artificial sunlight to the extent that it is used in institutions of this sort, but I have every reason to believe it can be used perhaps as effectively.

There is one advantage the work the Major is doing has, which a man not specializing in this work does not have. He tells them it will take a year or two, and they get in the position he sees fit to put them, and there they stay. The man in general practice does not experience coöperation of that sort. But in a limited way, we have been doing some of the work—not long enough to speak with authority, yet we feel beyond all question that we have had definite improvement; and, on the whole, the treatments have been very satisfac-

tory in cancer and pulmonary tuberculosis. Just how long it will last so far as we are concerned or whether or not it will be permanent, is a matter to be proven. We are satisfied with some of the results we have gotten to date, and have every reason to believe a great deal of good may be expected from this method of treatment.

Dr. J. C. Buntin (Augusta, Kans.): I am very much interested in the paper. I think it is very important, especially in joint tuberculosis.

I remember a case of tuberculosis of the hip joint on which I tried ordinary methods for six months. The x-ray did not show very much improvement at the end of that time. This spring I started in with heliotherapy, giving an introductory five minute treatment, front and back, and gradually increasing the amount of exposure and the amount of the body exposed. Eventually he was getting four hours of sunlight over the entire body and absolutely naked. We had an ice bag at his head and goggles over his eyes. In three months the x ray showed the necrosis had entirely cleared up and the temperature which he had been running left in three weeks. Since that time he has had no temperature. He is working now. You could not tell him from a Mexican when we got through with him, and he had gained twenty pounds. His constitutional condition is excellent.

Dr. D. T. Quigley (Omaha, Nebr.): I want to add my own testimony to this treatment. Eleven years ago I put in nearly a whole year in Vienna. I was in the clinic and saw a great many of these little children with surgical tuberculosis treated with casts, living on a board, leading the most uncomfortable lives. I do not think I ever felt any more sympathy for any class of patients than for these poor little fellows in the Orthopedic Clinic in Vienna in 1913. I thought, "how unfortunate that these cases must be treated with casts—with these big, heavy things to keep out the air and sunlight!" I did not know any better.

A few weeks later I saw Dr. Rollier's work, similar to that being carried on today by Dr. Myll. I was astounded at the result he was getting with no casts, no discomfort, letting them run in the sun without any clothes, the boys on one side of a big fence and the girls on the other.

I saw photographs of elbows and knees and wrists where they had come in swollen and running pus, and two months after the photographs were taken there were perfectly normal and useful joints. I saw the work myself eleven years ago.

I have not been engaged in that kind of work, but I have had a keen appreciation of its value. Every time I have seen a thick cast put on a tubercular patient and have seen them kept away from the sunlight, and the fresh air kept away from the skin, I have felt that something very near to malpractice was being perpetrated on those patients.

We can carry this message home today, that the Major has demonstrated this thing can be done in this country as Dr. Rollier has done in Switzerland.

I do not think Iowa is worse than Kansas or Nebraska. They have some sunshine in Iowa. They do not have all cloudy weather. If they just get a shot of sunshine occasionally, when the sun does shine, they can get results.

I had occasion to use my new-found knowledge on a child with both hips tubercular. We found one of the lower lumbar vertebrae secreting this tubercular discharge from both hips. He was very anemic, almost a living skeleton. He lived at Cozad, Nebraska. I told his folks to take him home, build a sun porch on the south side and put him on a couch, and instructed them to give him so many minutes on his back, then so many minutes on his belly the first day, and five minutes more the next day, taking advantage of the treatment as the sun would shine, and keep away from windows. A lot of people will get the sun through a window, which does not do very much good. They must get it without an intervening substance because the glass cuts off the actinic rays. We sent him home, a sixteen-year-old boy. In a year he was well. Both hip joints are ankylosed. If we had put him in a cast and given the treatments they gave in Vienna, and which I saw later in London, I am sure this boy would have been killed.

Major Myll: I do not know whether I can answer the doctor's question about lime in the blood. Several observers have reported that there is a definite decrease. Other observers could not demonstrate this phenomenon. It is true, the first change we

see on the x ray of a tubercular bone is a rarefaction, probably a diminished amount of lime salts. It is probable it has some relation to the lime content of the entire body, but I have been unable to find anything definite about it. We give calcium chloride because we have found by experience that it gives symptomatic results. We have not demonstrated any clinical effect on the lesion or disease.

Heliotherapy can be given any place where the sun shines. It is not necessary to get bright sunshine every day. In some localities where you have four or five cloudy days in succession, I think it is advisable to use artificial light therapy. I believe your results with artificial light therapy, using it when you can not get sunshine, should be as good in the end as in places where we get a great deal of sunshine, if you will remember light therapy in tuberculosis is only one factor in the treatment. It

is not the whole treatment. Your patient must have mental and physical rest, if possible. If a spine or joint case, he must have rest of that part. The fresh-air treatment is just as important, probably, as the sunshine, and all must be used.

In a disease as serious and chronic as tuberculosis, we must use everything we possibly can to overcome it, and certainly sunlight and artificial light are great additions to what we used ten years ago; but it is only one part of the treatment.

We find two hours in summer at Denver and three in winter work well for the average patient. We have a few who have taken sun for a longer period, and some can not take it as long. Work it out for yourselves. Probably in this locality a great many patients can take four hours in summer and five in winter. Do not over-expose. If they get dizzy and the pulse runs up, stop the treatment. Next day cut down at least

one-half hour for the entire day. Do not overdo the thing. You get a general reaction which will cause more harm than the good you are accomplishing.

Dr. W. A. Anneberg (Carroll, Ia.): I should like to add a few words in regard to the chemistry of the blood. We have done some work at Iowa City, more in ricketts than in tuberculosis. We have found at the initial stages that there is a low blood calcium—usually around five or six mg. per 100 c.c. We do not give our calcium in the form of chloride intravenously. We give it in ordinary cow's milk by mouth with cod liver oil and ultra-violet ray. In practically every instance, the blood calcium was up to normal, or ten milligrams per 100 c.c., within five days.

Dr. H. G. Crawford (La Junta, Colo.): Isn't it a decided advantage to immobilize your spine when treating tuberculosis of the spine?

Major Myll: Yet, it is.

Communication of the Royal Hungarian Peter Pazmany University Clinic for Internal Diseases*

NANDOR RATKOCZI, M. D.

Department No. III. Leaders Accommodation
Leader of the Roentgen Laboratory.
Director: Alexander Baron de Koranyi. Also Three Chambers Accommodation of the Modern Roentgen Laboratory, Budapest, Hungary.

THE modern therapeutic roentgen plants must be installed according to the so-called "three-chamber" method. A separate engine house has to be provided for the plant, which, because of its size, cannot be placed in the cabinet box as can be done with the older plants of smaller size. The switching room must be separated from the handling room in order to protect the staff adequately against the multitude of penetrating rays. All three localities should be sufficiently spacious, light and well ventilated. The separation of the engine house from the constituent parts of the plant (transformer, inductor, high tension, rectifier, interrupter and so on) have been placed in the cellar or in the loft. This arrangement was, however, not suitable, for the control of the engines was inconvenient and the leading of the electric transmission sometimes caused diffi-

culties. For the present it is our endeavor to have all three localities horizontally located. If there is the possibility of constructing a new building, the solution to the problem is comparatively simple. We place the three localities close to each other: (1) The engine house opens from the corridor and transmissions are led through the wall. (2) Close to it is located the handling room, in which the therapeutic table and the stage are placed together with the milliamperes and the Coolidge amperemeters. (3) Separated by barium or lead walls and lying adjacent to the handling room is the switching room, from where the patient in the handling room, as well as the meters, may be watched through the leaden glass window in the barium wall. The engine house is ventilated and lighted from the corridor. The handling room is ventilated and gets air from above (top light and top ventilation). The windows of the switching room open out on the garden-street (Sur-

gical Clinic of Leipsic).

Much more difficult are accommodations where existing localities have to be adapted and the application of a top light to the middle room is impossible. In our clinic we had at our disposal two rooms for the installment of the large "radiotransverter." Intending to maintain at any cost the three-chamber method and wishing every room to be convenient and well lighted, we have solved the problem of installation as follows:

Figure 1: In the first room (dimension 8 by 3.2 meters) at the window (1), we have installed the transformer (1), and the high tension rectifier (2), as well as the two small Coolidge transformers (3 and 4). The engine house is separated from the inner part of the locality and the switching room (II) by a glass wall (5) which reaches up to the ceiling. In this switching room there is the main switchboard fixed to the wall (6), as well as the switching trolley (7). The sufficiently spacious local-

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ity is made habitable and serviceable for a small office by a writing table (10), bench (14), and writing desk (13). The switching room is separated from the corridor-waiting room by a glass folding door (9) which increases the light emanating from the glass wall and thereby gives sufficient ventilation for the locality. The draught of air may be as easily produced by an appliance at the glass door as through this door. The door to the right (11) serves for communication with the other neighboring irradiating locality; the door to the left (12) leads into the large room. The wall between this latter door and glass wall is 240 meters high and is covered with a leaden wall (5 mm. thick, weight 330 kg.), fixed on hard wood, which together with the 60 cm. thick brick wall, affords perfect protection against the dispersing rays in the working (handling) room. In the leaden wall, there is a window (8), of 40 by 50 cm. size, which is covered by 20 mm. of polished leaden glass.

The dimensions of the working locality (III) are 7.30 by 6.40 meters. In the part towards the corridor are three dressing boxes (a, b, c), and at the wall in front of the switching room are two therapeutic tables (1, 2). Above the first table (1), fixed to the ceiling is a tubeholder similar to the Siemens hanging-stage; to the second table (2), is added a Koch and Sterzel therapeutic stage. On this table photographs are taken by means of a Lambert stage. Close to the wall, near the window, the trochoscop is installed (3). In front of it stands the transformed Sommer screening stand (4), which is perfectly enclosed by the till which is fastened to the wall reaching the leaden house. Before it is placed the projecting wall of the operator (5)*, and to the right of it stands a writing table (6). The large window is sufficiently darkened by a double-flapped thick curtain.

Figure 2: The high tension transmissions (8 mm. produced by brass tubes) proceed from the engine house, and come out of the high-tension rectifier. They are carried by dark glass plates through the mural breaches into the large room, two by two, positive and negative, taking such a direction, that every available working place can easily be connected with the two cables. The transmissions are, of course, fixed to the iso-

lated bars on the ceiling. The meters are placed in the engine house. The two Coolidge amperemeters are connected to the negative transmission. The Coolidge transmissions are running in the tubes of the negative transmissions, the two milliamperes are joined to the positive transmissions, the adequate ones coupled close to one another. Their placement is so arranged, that all four meters are visible from the side of the switching trolley through the large polished glasses located in the glass wall.

Figure 3: The therapeutic handling is very simple. Patients are placed on the tables (1, 2) after the two tubes have been focused. They are left alone in the large room. The dosage is controlled from the switching room by aid of the leaden glass window. In cases of severe disease, the patient holds a signal bell in his hand, by means of which he may in-

dicate any wants. The person in charge is perfectly isolated, free from rays, and is working in a well lighted room from which he can watch the meters placed in front of him and at the same time the patient.

When taking photographs, the leaden glass window is held open in order to keep up the verbal intercourse with the patient and to control the photographing.

While screening, the handling room (III) is dark. The leaden glass window is provided with a small black curtain, which can be drawn. Communication between the operator and the switcher is maintained by means of the bell and light signals. Switching on and switching off is indicated by each one ringing an electric bell which hangs down from the diaphragm-regulator of the screening stand.

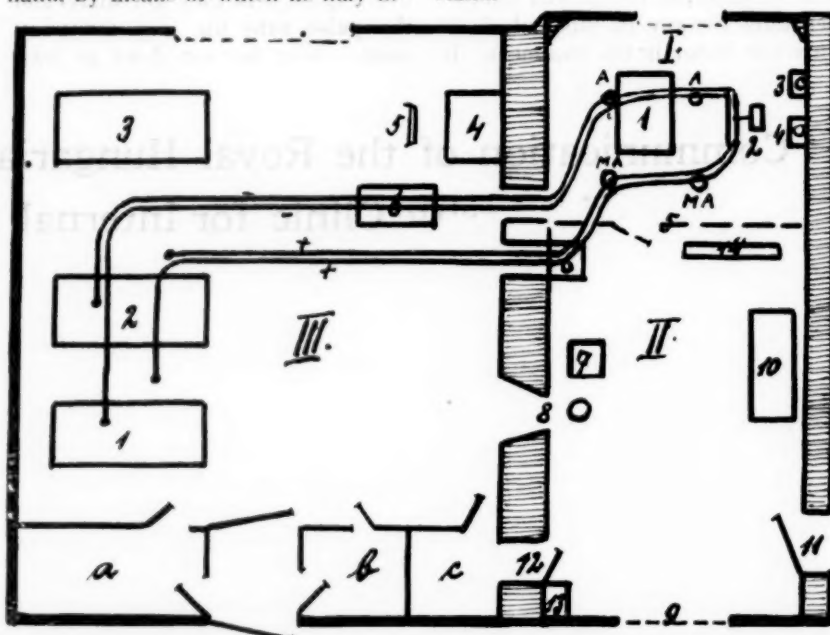


Fig. 1—Diagrammatic arrangement of the three chamber accommodation of the modern roentgen laboratory.

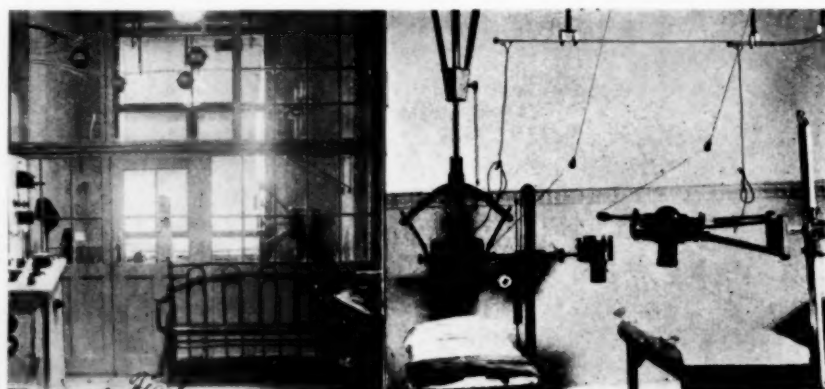


Fig. 2—The placement of the four meters in the engine house.
Fig. 3—The two therapeutic tables and tubes.

On a small table at the foot of the screening stand are located four ignition pedals. In front of the switching table four small lamps are placed which contain the following directions: *more, less, softer, harder*; which call to the attention of the switch operator the desired variation of the Coolidge high tension current.

We have, therefore, perfectly succeeded in achieving the "three chamber" method. All the three rooms

are light, airy, and adequately separated from each other. The new method deviates from that one used heretofore in that the recording instruments (the milliamperes and amperimeters) are installed in the engine house. This change offers a great advantage in therapeutic practice: the meters are constantly before the switch operator, they are much more convenient, and safety is assured the diagnostician. Furthermore,

the switcher is working in a light locality and is able to watch the instruments constantly.

A year's working under such an organization has proven the accommodations to be perfectly adequate, so that no change seemed necessary, and it simultaneously offers the greatest possible convenience and security.

*Description vide *Klin. Wochenschrift* 924 November 10.

Diathermy in Internal Medicine*

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THIS paper will concern itself with the general principles underlying the use of diathermy in the treatment of conditions that the internist is called upon to handle. Detailed technique is not given, as that is readily devised when the general principles are understood. Technique is the art of physiotherapy, whereas this paper concerns itself with the science thereof. To ensure a proper conception of these principles, it is necessary to begin with a discussion of the physiological action of diathermy. What happens when a high-frequency discharge is passed through the body can be discussed under three main headings:

1. The current heats the tissue through which it passes, in direct proportion to the intensity of the current and the resistance of the tissue. Every conductor offers some resistance to the passage of an electrical current, and is heated proportionally. In the case of some substance this resistance and the consequent heating is of such a low degree that it is not recognizable by ordinary means. In others, as for example the filament of an electric light bulb, the degree of heat is very high. The living human tissues offer a definite resistance to the passage of the current, and the heat produced is readily recognizable and measurable by ordinary physical means. The effects of the heat on the tissues are similar to the effects of heat applied by any other method:

(a) General relaxation of all contractile tissue and relief of

pain due to spasm.

(b) Dilatation of precapillary arterioles by vasomotor relaxation, with increased circulation of blood, resulting in increased supply of biological means of local defense and repair, increased elimination, and relief of pain due to congestion.

(c) Increase in the rate of local metabolism, depending on the principle that all chemical reactions increase in speed with a rise of temperature.

The difference between the effects of diathermy and those of external application of heat, is that the above physiological phenomena can be produced by diathermy within the tissues at any desired depth below the surface, whereas with external application of heat, the highest temperature and the greatest physiological results thereof are always directly at the surface, and decrease rapidly with increased distance from the surface.

2. The current has a direct paralyzing effect on the vasomotor nerves, quite apart from the dilatation that is produced by the heat developed. This can readily be demonstrated by applying diathermy directly at the skin surface (by the indirect method)—a red spot of engorged skin appears long before enough heat has been produced to be responsible for this effect. In all probability there is an initial vasomotor stimulation with a decrease in circulation. Could we keep our current intensity low enough and observe quickly enough, by proper methods this preliminary contraction would doubtless be recognizable; but in practice it is quickly

followed by vasomotor paralysis with increased capillary circulation. There is evidence that there is also a slight depressant effect on the sensory nerves. The great value, however, lies in the increased volume of blood brought to the part being treated. To increase local nutrition and metabolism, and to promote local elimination, is sufficient treatment for ninety-nine lesions out of every hundred. In the vast majority of cases, nature knows *how* to handle the trouble, but is in need of reinforcements. She has the proper kinds of antibodies, phagocytes and repair material, but has difficulty in getting a sufficient amount of them to and from the place where they are needed.

3. The third effect is that of the electrons acting directly upon the molecules composing the tissue. Like a spinning top that stands up quietly because it is spinning so rapidly, the tissues maintain their stability because of the powerful accurately balanced forces that are active within them. The molecules are separated by spaces enormously wide in proportion to their size, like the planets in the solar system, or like polo players in the field; they move with great rapidity within the limits of their fixed orbits. If we had some sort of vision by means of which we could see into the structure of a cell, these molecules, symmetrically arranged, moving rapidly about in vast spaces, would present a wonderful sight to us. Now, if we could look within each molecule, we would find its structure very complex. We would see hundreds of atoms, disposed systematically, moving in orbits, separated by great distances, vast depths

*Read at Chicago Physiotherapy Meeting, October 21, 1924.

like those between the stars in the heavens, and a play of tremendous forces so balanced against each other that external quiet is the result. This is comparable to a well-made motor which, enclosed, may be developing a large amount of power, and yet appear perfectly still. Within each of the atoms, the story repeats itself: electrons whirling swiftly in orbits and covering enormous distances, in mathematical arrangements, associated with the play of powerful forces, make up the atom. It is upon this energy-content of matter that life mainly depends. The actual amount of matter is relatively small; but orbit within orbit, force balanced against force, the vast amounts of energy that keep in motion these traveling and whirling bodies within a mass that externally appears quite solid and still, *these* are what life, and metabolism consist of.

Now, picture a stream of electrons shot through this system at immense velocity, first in one direction, then in the opposite. The high frequency current is composed of electrons of precisely the same nature as those which make up the atoms. They travel through the constellation of molecules, electrons, and atoms at a velocity beside which a machine-gun volley through a mob of people is stationary in comparison. There must be some effect upon the field through which they travel. What the effect is, has not yet been stated in scientific units of measurement. Since there is a large amount of space in comparison with the amount of mass, most of the electrons will go on through between the bodies that compose the molecules of tissue. But, by the law of probability, some of the electrons will collide with masses composing the tissue, so that in general, there will be an addition of energy to the tissue and a loss of energy from the stream of moving electrons. By proper graduation of the number of electrons sent through, the energy added to the molecular and atomic mechanism may range from a slightly beneficial action to a completely destructive one. In medical diathermy, we use such a number and concentration of electrons that the effect we obtain consists of impulses to the moving bodies, so that their existing motion is moderately stimulated or increased, without interfering with its character, or with the arrangement of the bodies. We reinforce

that activity without altering its character. We increase the rate of oxidation, of carbon-dioxide elimination, of blood flow, and of the multitudinous chemical reactions that are included under metabolism.

From these generalizations, we can reason toward the clinical applications of diathermy in actual practice. It follows logically that diathermy is applicable in cases where the following effects are required, either locally or generally: (1) Increase of blood- or generally:

(1) Increase of blood-supply and nutrition.

(2) Increase in rate of metabolism, oxidation, phagocytosis, antibody formation and action, etc.

(3) Increase of elimination.

(4) Production of relaxation.

The clinical conditions in which the above effects are desired, fall into the following general divisions:

(1) Chronic local debilitated conditions.

(2) Chronic inflammations.

(3) Acute inflammations.

(4) Toxic states.

(5) Neuroses.

By chronic local debilitated conditions we mean such things as varicose ulcer, eczema (especially the dry, scaly form), nonunited fractures, trophic sores, and similar chronic lesions, which persist because of lack of vitality and nutrition. The lack of vitality and nutrition may be local only, or general. If local only, these conditions respond very well to diathermy. Often a lesion appears to be merely local, when in reality there is a general deficiency in calcium metabolism; and the body is unable to mobilize the extra supply of calcium that is required in healing the lesion. In such cases, diathermy should be used in conjunction with general applications of ultraviolet light, and parathyroid therapy, to promote the handling of calcium by the body. If there is a manifest general cause for the failure to heal, such as syphilis, diabetes, tuberculosis, etc., this must of course be appropriately treated.

A systematic survey of the field of application of diathermy will reveal many gaps in our knowledge of the subject. *A priori*, it would occur to one that if diathermy is beneficial in stimulating the healing of lesions due to local lack of nutrition, it should provide similar assistance in systemic debilitated states, if applied through-

out the entire body. As a matter of fact, very little is known about this phase of the subject. It seems to be satisfactorily demonstrated that the high-frequency discharge will increase the metabolism of sugar in diabetes, when applied in the form known as autocondensation. It would seem that it ought to promote nutrition in tuberculosis, anemias, and asthenic states following fevers, exhaustion, etc. There is still much opportunity for research on this subject.

Chronic inflammatory conditions constitute the widest field of application for diathermy. In a long-standing inflammation, a condition of equilibrium has been established between the irritating influence, which may be an infection, a foreign body or a toxin, and the inflammatory reaction of the tissues, so that neither is able to win in the protracted struggle that is going on; there is a deadlock resembling those that were encountered in the trench warfare in France. It may be that one of the sides is winning gradually, but months or years must elapse before any decisive stage is reached. Examples of such conditions are pulmonary tuberculosis, chronic urethritis and prostatitis, female pelvic disease, chronic appendicitis, middle ear disease, arthritis, osteomyelitis, and neuritis. In using diathermy for these conditions, its direct germicidal effect is quite insignificant in importance. It is the increase in blood supply to the affected part, and the stimulation of the chemical forces of resistance in the tissues, producing a tissue reaction exactly like the one by means of which nature normally overcomes infection, which is the real factor in the cure of such cases. That diathermy is more effective in curing these conditions and relieving their symptoms than any other therapeutic agent of today, is a statement that requires no further elaboration at this meeting.

In acute inflammation, diathermy is not so universally applicable. An acute inflammation, such as, for example, a carbuncle, is an active process advancing toward a definite goal, and, in general, needs no assistance except favorable conditions under which to proceed, viz., rest, protection, and drainage of retained inflammatory products. In some cases, by beginning in the early stages and producing an intense tissue reaction before nature is able to produce one,

an acute process, like a carbuncle or an arthritis, may be aborted. It takes a definite and considerable length of time, from two days to a week, for the tissue reaction to reach a maximum during which the defense has not been established, while the invading organisms are gaining ground constantly and putting up a stronger fight. If we produce this maximum tissue reaction artificially by diathermy, we may overcome the infection before it is able to get much of a start. Likewise, in cases where the body is unable to produce a sufficiently powerful tissue reaction, either because of the overwhelming strength of the infection, or the lack of resistance, diathermy will assist in producing the inflammatory reaction. The acute local conditions which diathermy has been found most successful in combating are pneumonia, pleurisy, orchitis, and arthritis. In using diathermy for acute local infections, great care must be taken for fear that there is fluid present under pressure, especially pus. The reaction to diathermy will increase the production of the fluid, raise the pressure, which is a dangerous thing, since it may mean rupture in the wrong direction, increase absorption, or promote metastasis.

In toxic states, the usefulness of diathermy lies in the fact that it produces relaxation, dilates the peripheral capillaries, produces heat throughout the entire body, which must be carried to the surface by beams of water, and dissipated as perspiration, taking with it the material to be eliminated. Its efficacy depends largely on drinking plenty of water preceding the treatment. Diathermy may be applied to the entire body either in the form of autocondensation, or by the hand-to-foot method, in which the autocondensation handle is held in the hands, and block tin or mesh electrodes fastened on the feet.

Of the conditions requiring elimination by this method, the first to suggest itself is nephritis. In the two principal types of chronic nephritis, elimination by the skin, in order to lessen the burden of the kidneys, is the most important part of the treatment. In the hydremic form, or that associated with edema, a salt-free diet is indicated, while in the azotemic form, associated with low specific gravity and high nitrogen concentration in the blood, a protein-

free diet, must accompany the eliminative measures. The next condition that is benefited by this method of elimination is acute inflammatory rheumatism. Probably this method would be beneficial in gout, but I have never had this opportunity in my practice.

Another opportunity for research suggests itself. The present method of treating fevers with hot baths and packs suggests that systemic or general diathermy, which really have the same effect, should be very beneficial in acute febrile conditions. At present, no real information exists on the effect of this method in such toxic states as acute tuberculosis, otitis media, tonsillitis, la grippe, or intestinal infections.

It has been my own good fortune to watch the effect of general diathermy on a considerable number of psychoses. I am not arbitrary on the subject of the classification of psychoses—that is treading on controversial territory—but most of my cases have corresponded fairly well with the common descriptions of dementia præcox and manic-depressive psychoses. These are being regarded today as manifestations of toxic states. I do not claim any cures; but I have not observed a single case that did not experience some improvement from a sufficiently long course of treatment, and was not put into a condition in which the patient could live at home, with a little care. The above statement must be qualified—the cases were selected with a view to some hope of improvement, the treatment was not tried on cases that were manifestly hopeless. Furthermore, treatment included elimination of all possible physical defects and pathological conditions, and the building up of the general health.

The last division of cases to which diathermy is applicable consists of neuroses. In my own work, I have used diathermy more on neuroses than on any other class of cases, the term diathermy including any method of passing the high frequency current through the body and producing heat. It makes no essential difference what electrodes are used, whether the glass vacuum, the autocondensation pad, mesh or block tin plates; the fundamental phenomenon is the passage through the body, of either an entire high frequency discharge, or a part of it. In neuroses, the main factor of usefulness is the sedative

and relaxing effect, which is due both to the direct sedative action of the high frequency discharge upon the nerves and muscles, and to the effect of the heat generated throughout the body by its passage.

The well-established benefit afforded by autocondensation in hypertension, is to my mind a confirmation of modern ideas of the neurotic basis of that malady. Anything that relieves the high-strung nervous tension of these cases will lower their blood pressure. That the high frequency discharge will lower blood pressure is now established beyond a doubt, and the fact that this treatment will not lower high blood pressure that is due to nephritis, cardiac disease, or arteriosclerosis is a certainty. The same external circumstances that will produce high blood pressure in one person: possessing a hyperstimulated autonomic nervous system, or what is usually termed a nervous strain, will in others cause epigastric pain of the hyperacid type. Epigastric pain of neurotic origin is extremely common among business men; almost all of my business friends and acquaintances confess to it at some time or other. It is the product of our modern civilized method of living at high nervous tension. The pain is due to spasm of smooth muscle; and the spasm is due to the hyper irritation of the autonomic nervous system. This condition is frequently called peptic ulcer or appendicitis. In women the same causative circumstances will express themselves clinically either as dysmenorrhea with cramps, and prostration during menstruation, or in pain and stiffness in the occipital region and back of the neck. In all of these conditions, diathermy through the entire body is logical as well as beneficial, as it relieves the underlying cause.

The first treatment or two sometimes increases the patient's neurotic symptoms; but after they have become accustomed to the details of the method, they often fall asleep during the treatment. The sedative effect on the nervous system is no doubt aided by the steady, monotonous sound of the spark gap. The results of this treatment are permanent only in so far as the patient learns to avoid the influences that caused his illness in the first place. The actual effects of the current last only a short time, from a few hours

to a few days. If the patient continues to live under a high pressure drive that strains his nerves to the limit, his nervous system will continue to react as it did before. The treatment must include a little education in living.

A few words on contra-indications to diathermy are in appropriate in this discussion. There are two classes of conditions in which the use of diathermy is attended with danger. The first includes lesions in which there is danger of hemorrhage, such as pulmonary tuberculosis, uterine bleeding, and gastric or duodenal ulcer. The danger exists only if the diathermy is applied locally and of sufficient intensity to produce a marked reaction when the local increase in blood supply and consequent intensification of the histolytic activity may involve a blood vessel. I have never seen such a thing happen, nor even a well authenticated case report of it; but theoretically, the possibility seems reasonable enough to demand caution.

The second class of conditions in which the use of diathermy may be attended with danger is that in which there is a possibility of enclosed pus, as in joints, appendix, fallopian tubes, abscesses, osteomyelitis, middle ear infection, etc. Diathermy increases the tension. There is more blood in the part, and more inflammatory exudate, so that a rupture may result in an undesired direction, causing peritonitis or meningitis. Or, there may be forced absorption, with septicemia or metastases. In the treatment of local inflammatory conditions, if the diathermy does not readily relieve the symptoms, always be ready to suspect enclosed pus. When free drainage is established, the use of diathermy is logical and beneficial.

I have seen the statement in the literature that autocondensation, or general diathermy, is contra-indicated in cases where the blood pressure is low. This is the condition that we have in many psychoses, upon whom I have frequently used this procedure without the least untoward result. This treatment, although it lowers a high blood pressure, will not decrease a normal blood pressure nor a low one.

In conclusion, a few words on technique will be appropriate. In order to get the desired amount of current through the tissues without hurting the patient, the skin and the electrodes must be kept scrupulously clean, and constantly moist. Dirty electrodes or a dry skin will introduce resistance to the passage of the current, which will result in a high degree of heat at the surface, and cause burning of the skin without penetration of the heat into the tissues. Dirty electrodes and a dry skin will also cause small sparks and an extremely uncomfortable prickling sensation to the patient. If the electrode is moistened, and the current raised very gradually, the skin will be moistened and kept moist by its own perspiration. The beginning with a very low intensity and very gradual increasing of the current, is imperative. A sudden increase will not only dry out the skin surface, but will produce burns on the surface, and cause no internal reaction.

In applying cuffs, as in the treatment of arthritis or osteomyelitis, care must be taken that the retaining bandages do not constrict the limb. The swelling produced by the increased blood supply increases the pressure of the bandage, cutting off the circulation of the distal portion of the limb, like a tourniquet. Severe pain, ischemic paralysis, or gangrene may result.

When it is desired to heat the skin surface only, as in the treatment of skin diseases, or varicose ulcers, the indirect form of diathermy is convenient. The patient is placed on the autocondensation pad, which serves as the indifferent electrode, while the active electrode is placed at the side of the lesion. The greatest concentration of heat takes place immediately under the active electrode.

It is wise to make a practice of anchoring the wires that lead from the machine to the electrodes, at some point other than the one at which they connect with the body electrode. The wires are heavy, and the weight of the hanging portion drags on the connections at the electrode, tending either to displace the latter, or to become disconnected and cause sparks. The results may be theoretically

harmless, but they are very terrifying to the patient, and their practical result upon the treatment is very unfavorable. Lay a sandbag on the wire near the patient, turn it around a limb, hang it on a hook, or in some way take the strain off the connection at the body electrode.

The most important requirement for success in the application of diathermy to internal medicine, is correct diagnosis. In clinics and groups where the physiotherapist has cases referred to him by others who have made the diagnostic study, the problem is not so difficult; but the man who is working alone, has a great responsibility resting upon him. It is a great mistake to apply treatment on the basis of symptoms or "indications." It is this practice that gets us into trouble, and brings physiotherapy into disrepute among keen observers and clear thinkers. Physiotherapy is no exception to the universal rule in all medical practice, that diagnosis is the keynote to everything that is done. Unless the diagnosis is correct, the rest is blind guesswork, and is more apt to fail than to succeed.

Furthermore, by diagnosis is not meant merely labeling the patient with the name of some disease. It means a thorough conception of the anatomic and functional pathology. Then, if we bring to this a knowledge of the effects of the different methods and techniques on body structure and function, we will have no difficulty in selecting the proper procedure for each individual case, and in devising technique down to the last detail. In the field of internal medicine, it is not possible to make a list of diseases, with a method and technique to correspond to each. It is physical states that must be considered, and of these there are no two alike. Setting up such an ideal of procedure as we have mentioned makes it appear that becoming a physiotherapist is no easy task, and such is indeed the fact. But, the internist who will work by this method will have no doubts in his own mind as to the value of diathermy in his work; he will get results where he expects them, and he will not expect them where they are impossible.

Diathermy in Gynecology*

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DIATHERMY is defined as the application of a current of electricity of low tension and high amperage which will produce heat within the tissues of the body. This definition means very little to me, and I hope that it means just as much to all others present. Unfortunately, the average physician has a very meager knowledge of physics, his training in this respect probably amounting to one semester's course in general physics which, as I did, he passed more by the generosity of the instructor than on account of brilliant class work. Furthermore, his experience with electricity has caused him to fear it; he has seen the bad effects of electrical shock and high tension burns, and it is quite natural that the conscientious physician should hesitate to introduce into his practice electrical machines about which he has no knowledge except that they are capable of producing electrical currents of high potentiality. Even the most up-to-date medical colleges of the present day do not include a course of electrotherapy in their curriculum. However, electrotherapy is here and is firmly established, and I do not hesitate to say that there is no branch of medicine that has ever made the advancement in the short time that it has or that offers the great possibilities that lie in the physiotherapeutic field.

I was greatly impressed by an article by Waddington in the *Journal of Physical Sciences* wherein he discussed diathermy as understood by physicians on the continent of Europe. In Europe, this modality is in more general use than in America, and to the European physician, diathermy is heat and heat only, and differs from other kinds of heat only on account of its being generated within the tissues instead of being applied externally to the skin. It is a matter of position rather than of character or degree. He has probably heard that diathermy or internal heat, as he terms it, is due to the re-

sistance of the tissues to the passage of a high-frequency current, but this part of it is outside his field. He lets the physicists and manufacturers of electrical apparatus worry about that end of it and it does not matter to him whether the oscillations of current are set up by discharges from a Leyden jar or a common fruit jar. He purchases his equipment from a standard supply house and confidently employs it in his practice. It is the application of the modality that interests him and not how it is produced. When we American physicians, and they say most great Americans are Missourians, adopt this plan and begin doing pioneer work in electrotherapy, we will obtain results that will astonish ourselves and make the scoffers and skeptics sit up and take notice.

Diathermy or internal heat is produced by the exceedingly rapid oscillations of the high frequency current through the tissues of the body which act as resistance to the current. Inasmuch as these electrical charges pass back and forth thousands of times in the course of a second, and as the latent period of a muscle contraction is approximately one-fiftieth of a second, there is no response in the form of work and all of the energy is utilized as heat within the tissues. There is also a chemical or metabolic reaction marked by a breaking down or building up of protein substances; but this also is probably due more to the increased temperature of the tissues than to any catalytic action of the electrical current. This reaction has not been sufficiently investigated for us to discuss it intelligently as yet; however, we do know that whatever changes take place within the area traversed by the current, they are of a constructive and not a destructive nature, unless we concentrate the heat to so great a degree that electrocoagulation or actual dessication occurs.

APPLICATION OF DIATHERMY

Our next point is to consider in what way this internal heat will be beneficial in the treatment of disease.

In its action within the tissues of the body, diathermy does not differ materially from heat applied externally, but when we realize that external heat does not penetrate deeper than one-half inch below the surface of the skin before being neutralized by the blood stream, and that the internal tissues tolerate a greater concentration of heat than does the skin, think how much more effective the heat generated within the deeper tissues by diathermy will be than if applied externally. Now what are some of the therapeutic properties of heat?

1. It alleviates pain: This analgesic property of heat has been known and utilized by man throughout the ages and needs no discussion here. How many thousands of times have we prescribed the hot water bottle for every sort of pain from baby's earache to mother's cramps? I do not hesitate to say that for the relief of pain alone, heat is one of the greatest agents that we use.

2. It has a localized action: Some electrotherapists claim that it is possible to raise the temperature of the tissues traversed by the high frequency current to approximately 140 degrees F., while the general temperature of the body will not be elevated more than a degree or two. I cannot state from experience just how high it is possible to produce heat locally, but I do know that while the patient will perspire freely during treatment there is little elevation of the general temperature.

3. It increases the blood supply to the part: This is of great practical value in inflammatory disease, especially if it has become chronic. There is an increased flow of leukocytes to the part, a concentration of the opsonins, agglutinins, and other bacteriolytic properties of the blood stream, with consequent attenuation of bacteria and greater phagocytosis. It likewise hastens the absorptions of disintegration products, promotes the formation of fibroblasts and accelerates repair.

4. After effects: Last but not least, it leaves no bad after effects. In this respect it is certainly superior to med-

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icines where the side effects are often more disastrous or unpleasant than the disease itself.

APPLICATION IN GYNECOLOGY

I. Inflammations:

1. Acute and chronic.
2. Specific and non-specific.
3. Location.
 - a. Vulvitis.
 - b. Vaginitis.
 - c. Endocervicitis.
 - d. Endometritis.
 - e. Myometritis.
 - f. Parametritis.
 - g. Salpingitis.
 - h. Pelvic cellulitis (chancreoids).
 - i. Peritonitis (buboes).

II. New Growths:

1. Benign.
 - a. Warts.
 - b. Moles.
 - c. Papillomas.
 - d. Fibromas.
 - e. Cysts.
2. Malignant.
 - a. Sarcomas.
 - b. Carcinomas.

TYPES OF INFECTION

In discussing inflammatory diseases of the female organs, it is necessary to consider some of the etiological factors, or the types of infection commonly found. The most common of these are:

1. Gonorrheal.
2. Chancroidal.
3. Syphilitic.
4. Staphylococcic.
5. Streptococcic.
6. Tuberculous.

Now in what way will heat react upon these micro-organisms? It is well known by all that these organisms thrive best at the temperature of the blood stream, although they will continue to multiply at temperatures somewhat higher. However, there is a limit to their tolerance. The gonococcus ceases to divide or multiply when subjected to a temperature above 104 degrees F., and is destroyed by a temperature of 140 degrees in 30 minutes. Sampson claims that it is possible to raise the temperature of the tissues to a temperature of 138 degrees F. without damage to them, so you can readily see what advantages we have in treating gonorrheal infections by diathermy alone.

The chancroidal bacillus, or bacillus of Ducrey, is destroyed by only moderate elevations of temperature,

and as the lesions are easily accessible, diathermy should be almost a specific for this disease. All common types of streptococci are destroyed by temperatures above 125 degrees F. in from 10 to 20 minutes, while the staphylococcus will withstand 140 degrees for 30 minutes. The tubercle bacillus is also quite resistant to heat and chemicals, but succumbs to 140 degrees in 20 minutes.

Taking these facts into consideration, one can readily see that the heat acts almost as a specific agent in combating the infective micro-organism as well as in producing the general beneficial effect that I have already mentioned.

APPLICATION OF ELECTRODE

In applying the electrodes, we are guided of course by the location of the disease. In vulvitis and anterior vaginitis, a sponge (Figure 1b) electrode to the perineum and a larger

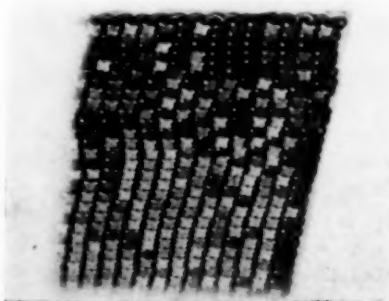


Fig. 1a—Mesh electrode.

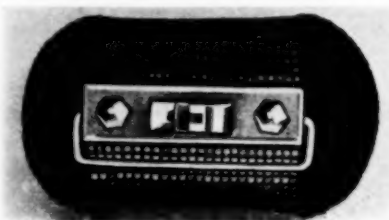


Fig. 1b—Combination mesh and rubber sponge electrode.

plate electrode (Figure 1a) over the lower abdomen are indicated. In inflammatory diseases of the internal female organs my special vaginal electrode (Figure 2) should be used. This instrument is introduced edge-ways into the vagina and rotated into position. When properly applied, it automatically engages the cervix within the cervical bowl and elevates and supports the uterus, while the vulva closes over the insulated vulval groove and helps to hold it in position proper. This is of practical importance, as all other types of vaginal electrodes will work out of the va-

gina during treatment. Furthermore, the vaginal mucosa will tolerate temperatures greatly in excess of what the skin will stand, so with this electrode it is possible to elevate the amperage considerably above what would be possible if the non-insulated tip came into contact with the external skin. The knees are flexed and widely separated while the electrode is being inserted, but the legs are extended parallel with each other during treatment, and the attachment cord from the vaginal electrode passes down between them to one of the binding posts of the D'Arsonval connection. The larger indifferent electrode should be of block tin or silver mesh (Figure 1a). It should be about five inches in diameter and is applied over the lower abdomen midway between the anterior superior iliac spines (Figure 3); the lower edge about two inches above the pubis. This electrode is connected to the other D'Arsonval connection of the high frequency machine and the current turned on. I advance the current gradually to 800 ma. the first day, treat twenty or thirty minutes and then turn the current off gradually. The treatments are repeated daily at first, and the amperage elevated gradually to the patient's tolerance. Some patients will tolerate as high as 1500 ma., but most of them complain of discomfort and a dragging down sensation in the lower abdomen when subjected to too high an amperage. Just what temperature we obtain within the tissues I am unable to state at present, but an invention has been perfected by which we hope to determine this point accurately within a very short time.

By the above procedures we treat successfully almost all acute inflammatory diseases of the female organs and a large percentage of the chronic. It is essential, however, that there should be free drainage.

CONTRA-INDICATIONS TO DIATHERMY

Where there is a walled-off abscess within the pelvis, this treatment should never be used. Chief of these is an old pyosalpinx or abscess in the cul-de-sac of Douglas. Either of these conditions if treated by diathermy will break down rapidly and rupture inside of the peritoneal cavity. I have had this accident occur in my practice a number of times, but with more careful pelvic examinations I have been able to avoid it lately.

The palpation of a small mass to either side of the uterus, or even a rigidity with slight deviation of the uterus to one side or the other, combined with some tenderness on pressure, should make one suspicious of an old pyosalpinx; and if we employ diathermy at all we must proceed very carefully, as one normal treatment will suffice to set it off. Even though there may be no pus present at the beginning of treatment, the increased heat to the affected area rapidly breaks down the devitalized tissue with pus formation. If the direction of least resistance is into the peritoneal cavity, the process will rupture into it with a consequent peritonitis with all of its attendant dangers.

The first few times that this accident occurred with me I rushed the patient to the operating room immediately, but I have since learned that it is just as well not to be too hasty. The bacteria have already been somewhat attenuated by the bacteriolytic products of the blood stream and the excessive heat. This is especially true if the infection is gonorrheal. Place the patient in a Fowler's position with icebags over the abdomen. Give a hypodermic injection of morphine to relieve the pain and inhibit peristalsis. Allow no food by mouth, but fill the patient with water by proctoclysis, hypodermoclysis, intravenous injection and, if necessary, by mouth. This neutralizes the poisons absorbed and lessens the prostration; when the shock has subsided, operate and drain.

I have performed a number of these operations and have not lost a patient as yet, and I am convinced that the only reason why some of them at least did not succumb to the peritonitis was because the bacteria had become less virulent due to the

factors mentioned above and the peritoneum was able to handle them.

TREATMENT OF NEW GROWTHS

The treatment of neoplasms brings us to a field of surgical diathermy or endothermy which differs from medical diathermy only in the degree of heat concentrated at one electrode. By using a finely pointed electrode (Figure 4), the heat may be so concentrated that it will produce a coagulation, a dessication or an actual charring of the tissues according to the amperage employed or its method of application. In removing small tumors of any kind from the external genitalia, I employ the following technique:

Touch the tumor near its base with an applicator dipped in pure carbolic acid. A white spot is formed which is anesthetized to the introduction of an injection needle. Using a novocaine solution from one-half to two per cent in strength, according to the field to be anesthetized, thoroughly inject the tissues underneath and about the tumor. If this is carefully done, the patient will feel no discomfort whatsoever from the treatment. I employ the autocondensation pad for the indifferent electrode, or have the patient hold the autocondensation handle in her hands. I believe, however, that I obtain more accurate results when I employ the silver mesh or large block tin electrode over the abdomen as in medical diathermy (Figure 3). This indifferent electrode is connected, of course, to one binding post of the D'Arsonval connection, while the pointed instrument is attached to the other. The machine is set to deliver 300 or 400 ma. of current at a very low tension. Insert the point into the tumor near its base, and using the foot switch apply the current until the tissue imme-

diately around it turns white, then switch off the current and insert at another point. Repeat this procedure until the mass is thoroughly cooked. It may be removed immediately or allowed to slough out.

This same method may be employed in removing tumors of the cervix, but unless the growth is attached to the walls of the vagina I usually incise it and cauterize the base with the electric cautery. In working within the vagina a glass speculum is very handy, but I employ the common metal speculum when using the cautery. In treating the cervix no anesthetic is required, as it is already anesthetized enough and one can burn it with impunity and without the patient experiencing any discomfort whatsoever. The only cases of carcinoma that I have ever treated successfully were treated by this method coupled with heavy doses of x-ray.

The above procedures are applicable to both benign and malignant growths. They may also be employed in the treatment of neoplasms within the abdominal cavity.

SUMMARY

1. Diathermy is not a complicated electrical modality but merely heat caused by the resistance of the tissues of the body to the passage of an electrical current.

2. This so-called diathermy or "internal heat" does not differ from other kinds of heat except by its location within the tissues. Heat applied by external applications is rapidly neutralized by the blood stream so that the deeper tissues are affected only reflexly.

3. Owing to the exceedingly rapid passage of the oscillations of the high

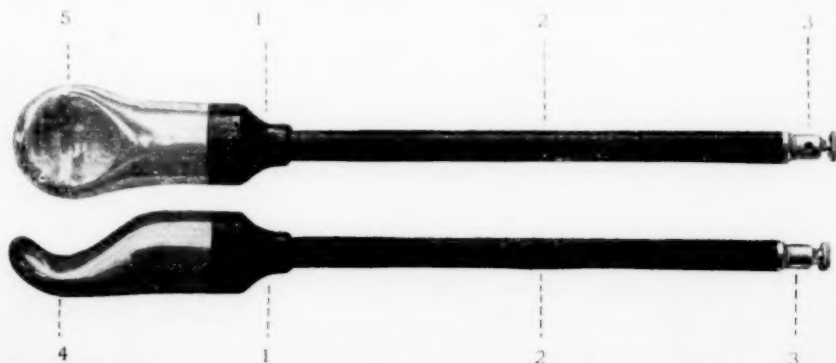


Fig. 2—Chapman vaginal electrode: 1, vulvar groove; 2, insulated stem; 3, cord connection; 4, non-insulated treatment tip; 5, cervical bowl.

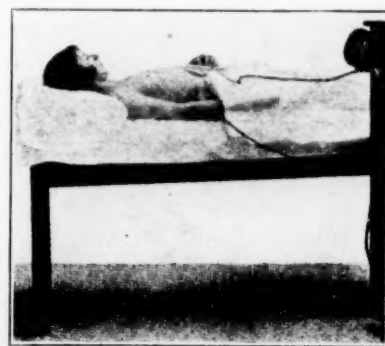


Fig. 3—Application of diathermy to the abdomen.

frequency current, there is no response to the electrical stimuli in the form of work, and the chemical or metabolic reaction that occurs is due more to the increased temperature than to any catalytic action of the current.

4. In the treatment of inflammations, diathermy has the following gross effects: (a) Bacteria are either killed or attenuated according to their power to resist high temperatures. This is especially true of the gonococcus and the bacillus of Ducrey, which are destroyed or their growth is inhibited by moderately low temperatures. The tubercle bacillus and the staphylococcus, however, will withstand temperatures almost in excess of the tissue tolerance, but are attenuated in virulence and rendered quite susceptible to phagocytic activ-

ity. (b) Diathermy increases the vascularity of the part with a concentration of opsonins, agglutinins and other bacteriolytic enzymes of the blood; it raises the opsonic index. (c) It accelerates the absorption of waste products and hastens repair. (d) It leaves no bad after effects.

5. Surgical diathermy constitutes the best and safest method employed in gynecology at the present time for the removal of either benign or malignant new growths.

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High Arterial Tension, Its Significance and Treatment*

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THE story of high arterial tension is not new, but its significance and proper management is indeed new.

Some of my writings have been criticised as puerile and elementary, and my efforts along the line of suggested interpretation pronounced virtually worthless on the ground that all physicians are logically cognizant of the fundamental factors governing blood pressure therefore competent to make their own interpretations.

While blood pressure physiology and the part it plays in pathology may be obvious to many, my acquaintance with physicians leads me to believe that to a far greater number it is still more or less an obscure field. However, one of the most heartening signs of the day is the intense interest manifested by the general practitioner in a most fascinating study of a highly important subject.

The *technical* definition of blood pressure is that it is the pressure exerted by the blood at a given time, and at a given point in the arterial system.

Blood pressure from a *physiological* standpoint means the pressure exerted from within on the heart, arteries, veins and capillaries.

FACTORS

From a clinical standpoint blood pressure should be considered from its fundamental factors; namely cardiac energy, peripheral resistance, resiliency of arteries, blood volume, viscosity, and pulse rate.

Cardiac energy or the power of the heart muscle to force the blood through the arterial system is not all expended in pushing the blood through the circulatory system. A no inconsiderable part of the energy is expended in stressing the elastic arterial walls that they may recoil on the blood and maintain the flow. The energy in the recoil has been likened to that of a second heart.

It is quite obvious that an artery that has undergone degeneration has lost a portion of its resiliency, and

is, therefore, incapacitated in its ability to store up energy. Under such conditions greater energy must be expended by the heart to maintain the circulation. Hence a higher arterial pressure, with a quicker and more powerful cardiac contraction, the output of volume of blood being the same, the systolic pressure will rise with little or no effort upon the diastolic. If the total volume of blood be increased, and the speed and force of the heart remains the same, the diastolic along with the systolic will rise.

Blood pressure depends upon the energy of the heart muscles, is maintained by the stored up energy in the arterial musculature, and regulated by the resistance offered in the various terminal branches of the arterial tree.

Blood pressure factors bear an evident analogy to those of electrophysics, voltage, amperage and ohmage. Cardiac energy may be comparable to voltage, blood flow to amperage, and resistance to blood flow to ohmage. With an increased resistance, the ohmage demands an increased potential, (voltage), to maintain the flow, (amperage).

The resistance offered to blood flow is found in the following factors: variations in the caliber of the terminal branches of the arterial tree, influenced by the vasomotor nervous system and direct pressure exerted by the adjacent tissues; changes in the components of the blood; contracted and dilated veins and capillaries.

The most important factor in blood pressure regulation is the influence exerted by the vasomotor nervous system through its pressor and depressor nerve fibers. An irritation of the pressor fibers causes contraction of the muscular fibers of the vessel walls resulting in their constriction. When the heart becomes overworked in overcoming an increased pressure, it seems to sense the condition and sends out a message through the depressor fibers of the vagus to oppose the action of the sympathetic, and partially or entirely restores the caliber of the small vessels, and equalizes the circulation.

Diastolic pressure is the constant circulatory load at cardiac diastole; systolic pressure is the circulatory load at cardiac systole. Pulse pressure, the difference between the systolic and diastolic pressure, is the increased load the arteries are compelled to bear during cardiac systole; it represents the extra effort of the heart to overcome resistance, or that pressure imposed upon the arteries to stress their resiliency. The wave thus produced is recognized as the pulse.

When the circulatory load is properly balanced, the pulse pressure bears the relation to the constant load or diastolic pressure as one to two, and to the systolic pressure or added load as one to three. However, it is my experience, that a systolic of 240, a diastolic 160, and a pulse pressure of 80, which is generally considered as the proper ratio of 1:2:3; entails greater stress on the arterial tree, than will a systolic of 240, a diastolic of 120, and a pulse pressure (P. P.), of 120 or 50 per cent above what is accepted as the normal ratio. Many physicians place great confidence in pulse pressure. If it is in the neighborhood of 100, they believe it to be the all-important pressure instead of the diastolic pressure.

While under ordinary circumstances the pulse pressure represents the added heart load, it does not seem to be as important a factor as the diastolic pressure or the constant circulatory load.

A constant load of 120 mm Hg. is twenty-five per cent less constant strain than a load of 160 mm Hg., regardless of the pulse pressure. It is equally patent that an added load with 100 cardiac systoles per minute entails a greater strain on the heart, than one with but 70 systoles per minute. For this reason, we realize the importance of the pulse rate. It is the constant minimum or diastole load, not the momentary systolic load, that wears out the heart muscle.

A patient may be constantly carrying a systolic pressure of 180, and a diastolic pressure of 80 (P.P. 100) and enjoy fairly good health. Under such circumstances we feel that with a pressure pulse at 100, that the heart is carrying an overload; never-

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theless, it is carrying a lighter load than it would if the diastolic were 120 and a pulse pressure 60, the proper ratio of the factors.

The interpretation of the sphygmographic record is essential. There is an ascending limb to the curve, and a descending limb which is interrupted by a dicrotic notch, followed by the characteristic dicrotic wave. The uppermost point, or crest of the wave, represents the systolic pressure, and illustrates the power of the heart—the work that the heart is doing. The base of the wave, or lowermost point of the pulse wave, designates the diastolic pressure, or the load that the heart is constantly carrying. The pulse pressure is the difference between these other two values. In other words the pulse pressure is the difference between the systolic pressure, the work the heart is doing, and the diastolic pressure, the load the heart is constantly carrying. To illustrate this point, let us consider the accompanying drawings. Figure 1, systolic pressure 240, diastolic pressure 120, pulse pressure 120; figure 2, systolic pressure 240, diastolic pressure 160, pulse pressure 80; figure 3, systolic pressure 120, diastolic pressure 80, pulse pressure 40. This is the *normal* pulse wave.

When I went to school, we used to make pictures on the blackboard. We would write under them: "This is a horse"; or, "This is a school." Well, these are not the Rocky Mountains, but are pulse waves. They are to demonstrate diagrammatically what I have just stated: that a normal blood pressure with a systolic of 120, and a diastolic of 80, the normal pulse wave, since the pulse pressure would be equal to 40, the ratio would be one-half the diastolic and one-third the systolic. We will suppose the diastolic is raised to 120 and the systolic is raised to 240. This has moved the normal crest wave from 80 up to 120. Suppose the wave starts with an 80 diastolic and goes up to a 240 systolic, you would then have a 160 pulse pressure—that pressure at a part of the time is affecting your heart. But this is altogether easier on the circulation than if we had a pulse pressure reduced to 80, because this is a constant load that the heart is carrying. Therefore the diastolic pressure is the important one instead of the systolic, as generally conceived.

My experience teaches me that a patient with a normal diastolic, a high systolic, and a normal pulse rate is not necessarily flirting with death. On the other hand, with a persistent diastolic of 120-130, that cannot be reduced, danger is lurking near.

NORMAL PRESSURE

Blood pressures vary widely under various conditions. Contrary to common belief, there is no pressure characteristic of any individual. There is considerable variations in the pressures of a normal individual. Through observation of thousands of individuals, by hundreds of observers normal has been accepted as follows: Systolic 110-142; diastolic 74-90; pulse pressure 24-55; pulse rate 72-86.

The systolic pressure taken alone is of little significance. The diastolic pressure may be of great importance. A diastolic of 120 has a greater significance than any reading of the systolic pulse pressure, the significance of which is stressed by many observers, does not impress me as being nearly so important as the diastolic pressure. However, to paint a satisfactory picture, all pressure must be considered in connection with the pulse rate.

A high systolic pressure suggests a functional disturbance. A high diastolic pressure suggests pathological changes. The systolic pressure is easily influenced by the following circumstances: position of the body, locality, time of day, exercise, diges-

tion, sleep, pain, excitement, fear, anger, physique, etc.

The old dictum that the normal systolic pressure may be estimated roughly by the formula, age plus 100 in case of men, and in case of women age plus 100 less 5 per cent is, to say the least, decidedly inaccurate. Of all the factors influencing blood pressure, age of the patient deserves the least consideration. It is generally recognized that added years, may add changes in the arterial tree, not by reason of age alone, but by reason of inside and outside influences, such as: overexertion; errors in diet; faulty hygiene; etc.

There is no good reason for an individual at the age of 70 years to experience a blood pressure materially higher, than possessed at the age of 25 years. However, being aware of the man's indiscretion, we naturally assume that the blood pressure of men at 60 is really higher as a rule than we expect to find in younger individuals. They say, a man is as old as his arteries. If that be true, I am good for another eighty years. My systolic pressure is 120, and my diastolic pressure is 80. Some would say, "You have hypotension. A man of your age should have a pressure of 160." Nay, nay, Mable. I have not destroyed my arterial tree with booze or anything else. I have preserved it very well with tobacco, and that is all.

While there is a difference in the pressures due to sex, at different periods in life, it is scarcely worthy

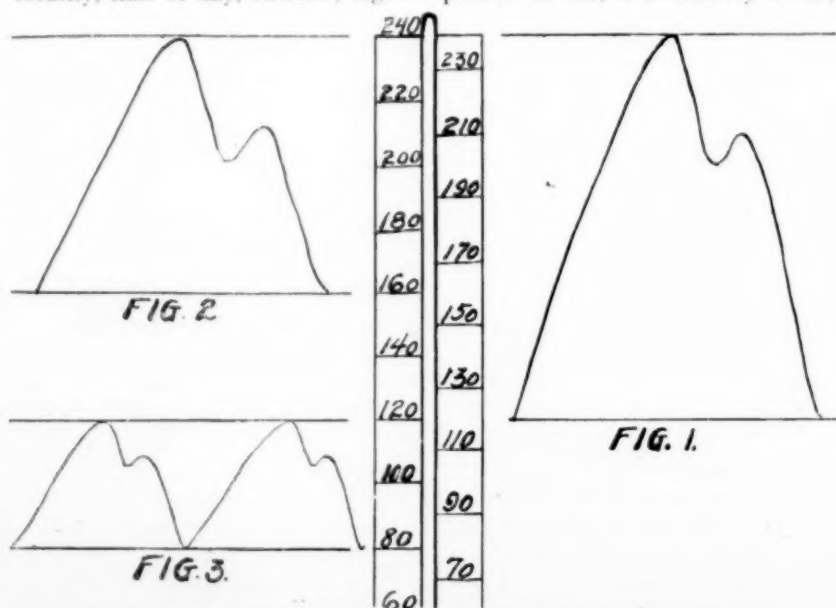


Fig. 1—Systolic pressure 240, diastolic pressure 120, pulse pressure 120.
Fig. 2—Systolic pressure 240, diastolic pressure 160, pulse pressure 80.
Fig. 3—Systolic pressure 120, diastolic pressure 80, pulse pressure 60.

of consideration. A safe rule to follow and retain in memory's embrace is the range of minimum and maximum pressures consistent with good health, and not overlook the fact, that a diastolic pressure above 100 mm Hg. is abnormal in any individual of any age, height, weight, or activity.

There is an etiology back of all functional disturbances, so there is back of hyperpiesis. However, we classify cases of hyperpiesis as those in which there is no discoverable pathology, and those of hypertension where there is a definite pathology.

ETIOLOGY

It is no easy matter to be sure just where hyperpiesis ends, and hypertension begins. While there are certain cases that we do not hesitate to definitely classify as hyperpiesis, and certain others as hypertension, there are still more cases that partake of the nature of both. Of this much we are assured, that hyperpiesis is a Paul Revere message which should arouse the best that is within us to combat this scourge of humanity.

We read in literature all sorts of adjectives applied to that word "tension." There are many of these qualifying words that should be deleted from blood pressure literature. Two definitions are sufficient: one "hyperpiesis," and the other "hypertension." The first is symptomatic; and the second is pathologic. There is the great field that we do not know between the two. They overlap, and Dr. Hester is an example of one of these cases. He has no discoverable pathology. Therefore he belongs to the hyperpietic group. But his blood pressure does not yield readily to autocondensation, and when that is the case, the probabilities are that he has pathology and we cannot locate it.

Thousands of printed pages in the past and present, have been and are now being wasted in argument tending to elucidate the problem—blood pressure etiology. While we are tentatively assured of certain factors being associated with hyperpiesis, we are unable to point to any one with any definite assurance of being right. Yet, we feel that the time is not so far distant when the causative factors will be discovered, and measures taken that will prevent the development of conditions which today are responsible for a mortality greater than that of cancer and tuberculosis combined.

There is no gainsaying the fact, that the wear and tear of life, due to methods of living and business activities contribute largely to arterial changes.

The average American rises early to take advantage of the other fellow; he hits hard, consequently a hard rebound. Sleeping hours are taken up with anxieties and worries of the day, and mental activity is stressed to the breaking point. He never relaxes for fear of being outdone; when he is not pulling on the tug-of-war rope he is pushing the other fellow to the wall. He drives fast without fear of accidents; he regards the signs, cautions, curves, bridges, as never intended for him; he drives faster and faster; his engine knocks; while he recognizes it, he considers it a waste of time to stop for repairs now; he pushes on, he is reminded by a passer-by that his tire is punctured; he slows up, secures a patch at the corner drug store and proceeds on his journey; the engine knocks harder and harder; power growing less and less; he feels the necessity of more fuel, he stops at the roadside inn and fills his tank, starts again feeling fine; he steps on the accelerator and *bang!*—an arterial blow out—a victim of too-strenuous a life.

A family history of overweights points to kidney dysfunction. A family history of infections above the average in number, points to cardiac failure. A family history of overactive mentality points to cerebral accident—while many cases of apoplexy occur in overweights, the general tendency is toward nephritis.

The quality of our arterial tubing is inherited, not unlike the quality of the garden hose; if first class it will withstand a long continued misuse; if of second class it will withstand a moderate strain for some time; if of the third class it will wear out early.

Again the quality may vary in different branches of the individual arterial tree. Intense mental concentration is accompanied with a rise in blood pressure, which falls to normal as soon as the mental strain is over. When daily anxieties are carried over to be rehearsed through the night, the pressure remains at a high point, and the vasoconstrictors are working overtime. Resistance is a constant factor; cardiac energy is increased; and arterial degeneration

takes place at the weakest point, which may be in the kidney, but more often in the brain.

The menstrual period of women is quite often accompanied with a rise in systolic pressure. This is probably due to some disturbance of the endocrine function, which is not well understood. Endocrine dysfunction may also have something to do with hyperpiesia in man.

Nature is bountiful in resources; large vessels may take on fibrosis with a compensatory dilation of the arterioles. So long as this condition prevails there will be no rise in blood pressure. On the other hand, if the arterioles become sclerosed, the compensatory heart soon fails in its effort to overcome the resistance, and the blood pressures rise.

The function of the circulatory system is to furnish blood to all organs of the body, and to furnish drainage. Any organ deprived of its nutrition through impendence of its blood supply soon loses its cell function, and the individual suffers in proportion to the importance of that particular organ.

Obstruction to blood flow favors thrombosis in the small arterial branches. When this occurs in the brain the cells in the immediate vicinity actually die, and the condition is spoken of as "softening of the brain."

Results following cerebral thrombus depend upon the locality and amount of tissue involved. A slight numbness in the extremities may be the only symptom; again, paralysis may supervene; the power of speech is disturbed or even lost; or there may be loss of memory, or complete unconsciousness.

PROGNOSIS

It is unwise to even hazard a prognosis in any case of high arterial tension. The final outcome largely depends upon the inherited quality of the arteries. The tendency, of those who suffer from mental strain, is toward cerebral accidents; the hearty eaters, to the complications of nephritis; and the physically overworked, to myocradial failure.

It is a common observation, that many individuals carry a high arterial tension for years with but slight inconvenience. On the other hand, an inherited arterial weakness favors an early giving away of the smaller vessels. The tendency toward certain

diseases in the family is of great value in prognosis.

A persistent diastolic pressure above 90 should be viewed with suspicion, while a diastolic pressure above 100 means pathology, somewhere in the circulatory system. A sustained diastolic of 130, which cannot be reduced, points to a fatal termination within two or three years.

The mortality rate as shown by insurance companies increases in leaps and bounds, as the systolic pressure exceeds 150. At a systolic of 150, the increase in mortality over the average reaches 34 per cent, and at 160 and over, 400 per cent.

Where the systolic pressure reaches 140 in a pregnant woman, otherwise normal, eclampsia is to be anticipated. A fall of the systolic pressure after exercise suggest myocardial failure.

METHODS OF TAKING BLOOD PRESSURES

On account of the various methods employed, with chances for inaccurate reading and consequent misinterpretation, I believe that a few minutes consideration of recording the blood pressure will not be without profit.

The tactile method, outside of its use as a check to the auditory method, is of very little value, and the oscillatory method is practically useless. The most approved method of taking blood pressure is as follows: Be assured of an accurate registering instrument, mercury column meters are to be preferred. A choice between the right and left arm is one of convenience. All clothing should be removed to the axillary line, and the arm put at rest and well supported. The cuff should be at least five inches in width; and the upper border applied well up to the axilla. It should be snugly applied; and the air bag should be slowly inflated until the meter registers at least 80. The bell of the stethoscope should be placed over the brachial artery immediately below the cuff. The bag is slowly inflated until the meter registers ten points above which all sounds cease. The air from the bag is then slowly released, and the first sounds heard will be noted as somewhat muffled followed by a more or less distinct click. This reading should be recorded as the systolic pressure. Some physicians record the first sound as the systolic pressure, which is from four to eight points too high.

To obtain the diastolic pressure, the valve is slightly opened, and the air allowed to escape gradually. Usually strong heart sounds are heard followed by more or less muffled sounds; the point where all sounds ceases is recorded as the diastolic pressure. In England and other foreign countries the point where muffled sounds are first heard is recorded as the diastolic pressure.

This may be well enough, but I believe the point, where all sounds ceases, to be the correct one. The diastolic pressure is not always easy to read; if the air from the bag is allowed to escape too rapidly the diastolic reading will be too high. To avoid mistakes all readings should be recorded at least three times. The second and third readings should be the same.

Among the factors as sources of error in estimating the systolic pressure may be mentioned: a large fat arm; edema; cyanosis; spasmodic muscular contraction; arterial spasm; calcification of the arterial wall; and psychic phenomena. A very common error is too prolonged compression. During the first examination of the patient in the office, all readings are liable to be faulty. There may be a difference of pressure readings in the two arms, due to anatomical, physiological, or pathological conditions, which if present must be considered.

To thoroughly understand the significance of blood pressure readings, first of all a careful family and personal history must be taken followed by a systematic physical examination. An ophthalmic examination will often yield information, that can be obtained in no other way. A complete laboratory report on renal efficiency and blood components is advisable in all cases.

In taking the family and personal history of a patient with high arterial tension, after you have examined one or two thousand people, there will be an impression made as soon as you are through with this history of the prognosis in this particular case. I have made a mental prognosis in many cases on history alone without any reference to blood pressure. I keep a record of all cases with my guess marked with red pencil in the margin. I find after fifteen years that my guesses are seventy-five per cent good without any reference to the pressure.

TREATMENT

The treatment of high arterial pressure depends largely upon the picture presented by clinical and laboratory findings. In hyperpiesia, reliance must be placed entirely upon the clinical data since the laboratory findings are negative.

The rest in bed for a protracted period, with a low intake of food and fluids, is of value in hyperpiesia is not questioned. However, it may be said that such management is not necessary except in rare cases. The same may be said of hot baths, and sojourns at the various health resorts. Mineral waters more often aggravate than benefit hyperpiesis. Cases are benefitted in which mineral waters increase urine flow and bowel activity.

It has been my privilege to observe the effects of certain waters upon blood pressure, and as a result I have come to the conclusion that the contents of many mineral waters prove irritating to the kidneys, and increase peripheral resistance. Except wherein they have a direct effect upon the causative factor, drugs are useless in hyperpiesia.

Baths that produce diaphoresis, as a general rule are useful in hyperpiesia, but not in hypertension. A stereotyped dietetic management of high arterial tension, so popular with the profession, except in cases of food anaphylaxis, has been proven a dismal failure.

The quality of food intake is not so important as the quantity. The diet should be the minimum quantity compatible with health. Only bad effects result from starvation.

A limited amount of animal protein is advisable in most cases of hyperpiesia. Elimination of salt from the diet is of no great importance except in cases of cardiac decompensation. A diet weighed by common sense is to be preferred to one weighed in calories.

Large quantities of fluid intake, except where they increase urine flow, aggravate high arterial tension. All kinds of soups are contraindicated. Until we acquire a more definite knowledge of the causes of hyperpiesia, its treatment must be more or less empirical.

While autocondensation is not a *sine qua non* in high arterial tension my experience teaches me, that the benefits derived from its use equal those of all other measures combined.

HIGH ARTERIAL TENSION—GROVER

The effects of autocondensation in all cases of hyperpiesis are quite prompt, and in most cases, lasting. Failure of autocondensation in high arterial tension comes from: first, a bad diagnosis; second, an imperfect understanding of the physics of high frequency currents; third, inefficient apparatus; fourth, bad technique; fifth, want of persistence, or too early cessation of application. As a discourager of pathology yet to come in the arterial tree, autocondensation has no peer. The success of autocondensation in hypertension depends largely upon the degree of the damage already done.

In cases of kidney dysfunction with a slight albuminuria and slight increase in the number of hyaline casts, the proper high frequency application will many times transfer the case from one of hypertension to one of hyperpiesia. Ninety per cent of these are amenable to autocondensation, plus good hygiene.

It has been my fortune to restore

the resiliency of many arteries crippled with fibrosis. It is no longer wise to say, we can do nothing for arteriosclerosis. Autocondensation technique must be varied in accordance with the condition of the patient. A big, fat patient with hyperpiesis requires an entirely different technique of application, than a thin, desiccated piece of humanity with arteriosclerosis. The treatment of a case of hyperpiesis must necessarily be different from one with a kidney pathology.

The fact should not be overlooked that every person with a persistent hyperpiesis is a candidate for future sclerosis.

The first essential in autocondensation is an efficient machine. There are many machines on the market, especially those of the portable variety, that are deficient in potential. The next requisite is a thick dielectric mattress, or couch pad. The chair with a thin fiber dielectric pad is a poor substitute for the couch pad.

The large use of the chair pad may be one of the reasons for not obtaining good results from autocondensation.

Another drawback in securing good results is the use of large amperage for too long a period of time.

There is nothing to be gained by giving a dose sufficient to cause diaphoresis. Milliamperages of 300 to 500 for ten to fifteen minutes are best for cases of hypertension. Here and there we find a case of hyperpiesis that does better with doses of 600 to 700 millamperes. Blood pressures that cannot be reduced to approximately normal belong to the hypertension class.

Let it be understood that no claim is made that autocondensation always yields favorable results in hypertension. However, favorable results may be looked for in ninety per cent of cases of hyperpiesis, provided efficient apparatus and proper technique be employed.



Intranasal Ultraviolet Applications Under Direct Vision*

ELLIS G. LINN,

Des Moines, Iowa.

NO rhinologist would ever think of making an application of any preparation to the septum, turbinals or sinuses except under direct vision. The uncertainty as to reaching the desired area even with the small cotton covered probe, except under direct vision, would dictate to any rhinologist

that he use his head mirror in every intranasal treatment.

It is equally desirable that intranasal ultraviolet applications be made with accuracy and that any parts of the nasal mucosa desired to be treated be subjected to direct radiation.

It is impossible to ray the less accessible parts of the nares with any degree of certainty or to be even

fairly sure that the major areas have received evenly distributed and definite dosage when the position of the quartz applicator can only be estimated by the relative positions of the lamp and general position of the patient's head, together with the sensation of intranasal obstruction felt by the hand supporting the lamp and, in the more restricted spaces by the sensation of tissues impinging upon the distal surfaces of the quartz rod. Maximum obtainable results will be had only through definite dosage under direct vision.

An ordinary quartz nasal applicator is bent on the horizontal at an angle of 35 degrees, one-fourth inch after its exit from the cone shaped metal quartz rod holder which anchors it to the lamp. A three-fourth inch section of rubber tubing slipped inside of a thimble and pushed down over the metal fingers which clasp the quartz rod inside the cone shaped metal holder will increase the pressure of the fingers and will hold the rod firmly and prevent its rotating too easily while being used in a narrow nose.

No head mirror or other light is necessary as the prismatic end of the quartz applicator abundantly illuminates the field and a nasal speculum is all that is essential to enable the operator to ray the entire intranasal surface under direct vision.

The bend near the end of the applicator necessitates tilting the lamp fairly well up on end when passing the curved tip into the left maxillary sinus through an opening in the nasantrol wall, but this may be done with the head slightly forward or the patient may lie down on the left side during the treatment. In every other intranasal situation I have found it extremely satisfactory.



Fig. 1--Intranasal ultraviolet speculum.



EDITORIAL

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A. F. TYLER, M. D.,
Managing Editor

Annual Meeting.

THE third annual meeting recently held at Hotel Sherman, Chicago, was eminently successful from every point of view. The program was an excellent one, well distributed in all the branches of work included in the scope of the College. Radium therapy, x ray therapy, diathermy, galvanism, industrial surgery and quartz light therapy all came in for their share of discussion.

G. Betton Massey presented an able discussion of the use of zinc-mercury ions in the treatment of tuberculous sinuses. Beside the discussion of the pathology and the problems concerned in the treatment, he demonstrated the apparatus used in giving the treatment. He showed how the radio B battery can be used as the source of the current while electrodes cut from sheet zinc are attached to the battery by small silk insulated copper wires. The zinc electrode is then dipped into a solution of sulphuric acid for an instant, then dipped into metallic mercury. This covers the zinc with mercury. This electrode is then carefully inserted into the sinus, being careful to introduce it to the very bottom in order that the entire tract may be ionized. The indifferent negative electrode is then placed in contact with some adjacent portion of the body and the current turned on. The zinc-mercury ions are by this method carried into the infected walls of the sinus, sterilizing them and setting up sufficient irritation to cause healing with subsequent closure of the sinus.

Disraeli Kobak read a paper on the treatment of sinuses and fistulae by means of the galvanic current. This paper showed careful preparation and contained many valuable suggestions. The subject was discussed from the historical standpoint, the physical standpoint, the electrical standpoint and the clinical standpoint. The subject matter was logically arranged and scientifically accurate. The entire paper will appear in an early issue of the Journal.

A. L. Yocom discussed the treatment of malignant new growths by surgical diathermy, illustrating his paper by a large number of lantern slides of excellent quality. The slides showed the exact technique employed as well as the clinical results obtained.

W. Scott Keyting talked upon the value of physical methods in medicine. He showed the value of careful

history, physical examination and the various laboratory tests in order that a correct diagnosis may be made before treatment is begun. Lantern slides illustrated the value of quartz light therapy, x ray therapy and diathermy in the management of various diseases.

Frank E. Simpson presented results obtained in the treatment of thirty cases of carcinoma of the tongue by radium. His results were tabulated in such a way as to show the length of time each group lived after treatment. He showed the superiority of radium treatment in cancers of the tongue.

Ellis G. Linn gave a preliminary report of the results obtained in the treatment of nonsuppurating middle ear disease by diathermy. He reported a large number of cases and emphasized the necessity of careful otological examination before starting treatment. Differential diagnosis was discussed, suitable cases were cited and the technique employed was given. He demonstrated apparatus devised by himself for the proper administration of diathermy to the middle ear.

The paper by O. T. Criukshank called forth a "battle royal" where everybody rushed into the discussion. The result was gratifying because it brought out various view points as to technique in the use of medical diathermy.

The meeting would not have been complete without the fine commercial exhibits put on by the dealers in various apparatus. The mezzanine floor was occupied by the commercial exhibits and we wish here to publicly acknowledge the debt of the College to the loyalty and helpfulness of the manufacturers and dealers. The success of the meeting is due in large measure to their wonderful co-operation.

The Rontgen Society—London.

The meeting of the Rontgen Society held in the British Institute of Radiology at 32 Welbeck Street, London, on Tuesday evening, November 4th, marked the first of a series of monthly meetings scheduled for the session 1924-1925. At this time, President A. E. Barclay, M. A., M. D., delivered the presidential address: The Growth of Radiology.

The Journal of Cancer Research.

The Council of the American Association for Cancer Research authorized the formal transfer of the Journal of Cancer Research to the Institute of Cancer Research of the Columbia University, 1145 Amsterdam Avenue, New York. This transfer was accepted by the Institute and the necessary arrangements have been made to publish the Journal from the Institute, under the auspices of the Columbia University. Dr. William H. Woglom, who so admirably edited the Journal in the past, has retired. The responsibility of the Journal having passed into the hands of the Board of Managers of the Institute of Cancer Research, the editorship was transferred, therefore, for administrative purposes, to Dr. Francis Carter Wood, Director of the Institute of Cancer Research.

A National Institute For Radium Research.

The United States was the first country to recognize the fact that the organization of research on a large scale is a matter of the utmost importance for progress in

science, in industry, and in furthering the welfare of humanity.

A considerable number of important institutions for research are already established in biology, embryology, botany, astronomy, geophysics and terrestrial magnetism. Research in these and other fields is also being carried on by the Carnegie Institution. A number of other institutions for medical research are being conducted under the auspices of the Rockefeller Foundation. In addition to these, many good research laboratories in special branches of physics, chemistry, and metallurgy are kept up by private firms. In fact, progress in wireless communication, in air traffic, and in meteorology is due largely to extensive research carried on in the laboratories of the government and of a number of large industrial concerns.

In view of the existence of these institutions, together with the fact that perhaps 80 per cent of the radium now being used in hospitals and elsewhere was extracted in the United States from carnotite mined in Colorado and the surrounding districts, it seems strange that there should be no special institution in this country for research in the physics and chemistry of radium and other radioactive substances.

The first extraction of radium in Colorado was undertaken by the National Radium Institute, Inc., founded by Dr. Howard A. Kelly and Dr. James Douglas. This institute worked in close association with the United States Bureau of Mines and has done valuable work.

There is, however, no institution in existence such as one would expect in consideration of the importance of the research which should be done. What is needed in radioactivity is an institution devoted entirely to purely scientific work in this field. It must be an institution which is not working for strictly technical or medical purposes. There are already in existence a number of medical radium institutions in the United States which have a task of their own. Naturally they have not so much interest in the progress of the physics and chemistry of radium.

While the field of radioactivity has been the object of considerable effort in recent years, the possibilities of research have barely been glimpsed. The present state of our knowledge in this field is the result of twenty years of research carried on in the laboratories of Sir Ernest Rutherford, of Madame Curie (in the Institute of Radium Research in Vienna) and in the few university laboratories in this country (e. g. those of B. B. Boltwood, Herbert N. McCoy, George B. Pegram, Herman Schlundt and William Duane), and abroad, (laboratories of N. Bohr, Copenhagen; W. Soddy, Glasgow and Oxford; Lenard, Heidelberg, etc.). The United States Bureau of Mines has done valuable work in its laboratories in Washington, Denver and Reno (notably under the direction of R. B. Moore and S. C. Lind). The Bureau of Standards has also instituted a number of valuable investigations under N. Ernest Dorsey.

The work of nearly all these laboratories has been badly hampered by insufficient funds. As a matter of fact, Sir Ernest Rutherford was compelled to borrow several hundred milligrams of radium from the Academy in Vienna in order to carry out his most important investigations.

By now many of the important problems in the physics and chemistry of radium have already been solved. We can safely say that all the preliminary work has been done. What remains is difficult, but not less important. It can be done only in large institutions where ample funds and able investigation are available. Research must be done for its own sake. It can never be free

when it is entangled with short-sighted policies and the "practical" aims of commercial and technical institutions. We know, from experience in the case of other research institutions, that in the long run industry and mankind do derive definite benefits from apparently disinterested research.

The use of radium in which the public is mainly interested is in therapy. Granting that its use here is of great importance, few realize that further progress in the therapeutic application of radium depends largely on the development of our knowledge of the physics and chemistry of radium.

A solution to the problem of how sufficient and effective research in radium is to be carried on is suggested as follows:

A committee formed by the National Research Council should undertake the special problem of discussing the foundation of a National Radium Research Institute. A committee of this kind would, no doubt, be able to secure appropriations for this purpose by appeal to the public.

The writer has not only seen many radiological laboratories here and abroad, but has co-operated with others in the installation of the Radium Research Institute in Vienna (1910) and was employed by this Institute for ten years. His experience has led him to believe that the most effective institution for research in radium should be founded along lines suggested below.

A National Radium Research Institute should be erected on a large open space, in order to avoid serious disturbance of the work of one department by other departments. Several lots of two or three acres each, at least half a mile apart, would serve very well. The best location would be in the outskirts of a middle-sized town, with prevailing dry and rather windy weather, in a moderate climate.

The following departments should be provided for:

1. Administration Building and Standardization Laboratory (the latter being something like an extension of the department for radioactive measurements of the Bureau of Standards).

2. Physical Building I, for work with strong radioactive substances; this being a one-story building with a number of spacious rooms, well separated from each other by thick walls and arranged in one row. No open radioactive preparation should be used in this building.

3. Physical Building II, for work with open and other emanating preparations. This should be a one-story building, at a distance from Building I. It could also contain a vault for storage of radium, etc., and a large apparatus for extraction of emanation from radium solutions. Several grams of radium should be available. Five grams should be kept in solution in order to procure preparations for all branches of the institution.

4. Chemical Building should be erected near the second Physical Building, and should contain all laboratory apparatus for extraction of radioactive substances, determination of atomic weights, etc.

5. Special laboratory for work with very weak radioactive substances; devoted to the study of the radioactivity of the soil, the atmosphere and spring waters. This laboratory should be at least one mile apart from all other buildings, with ample space for outdoor experiments, not disturbed by smoke or other impurities of the air.

A chemical branch of this laboratory should have the complete outfit for the decomposition and analysis of rocks and minerals.

Spectroscopy and positive ray analysis should be provided for in Physical Building I. A modern x ray out-

fit should be available in Physical Building II, with all necessary high voltage generators, storage batteries, etc. Magnetic work with open preparations would be done in Physical Building II.

6. Another building should be devoted to biological experiments with radium rays, this having all necessary equipment for work in organic chemistry and histochemistry.

An institution of the qualities described would be able, when directed by first class experts, to attack any problem in radioactivity. Scientists in all parts of the world would be attracted to join the institution temporarily in order to carry out certain experiments. It would not be difficult to win men of the highest scientific renown from this country and from abroad for this institution.

A number of fellowships for graduates in physics, chemistry, and biology should be provided for. Under the direction of the department chiefs and their assistants, these men could help to solve many vital problems.

This National Research Institute would be quite unique—the leading institute of the world. Great care would, of course, have to be taken to choose the right men for department chiefs. The National Research Council is

the body which could best find the proper men.

Undoubtedly such a large institution would require ample appropriations. A very rough estimate can be made: lots and buildings, \$600,000 to \$800,000; radium (seven grams), \$500,000; apparatus and complete laboratory outfit, \$600,000; funds for the permanent upkeep of the Institute, about \$2,000,000. The annual interest of such a sum would suffice for salaries, fellowships and running expenses.

To make possible the establishment of a National Institute for Radium Research, an educational campaign for stimulating public interest should be initiated. Radium is performing invaluable services for humanity now. When the importance of further research as a means of making radium of still greater value to mankind is made apparent, the people of the United States will not fail to give this institution their unstinted support. Four million dollars is all that is needed. Who will initiate the campaign for funds to endow a National Institution for Radium Research?

VICTOR F. HESS, Ph. D.

Professor of Physics, University of Graz, formerly of the United States Radium Corporation.

ABSTRACTS *and* REVIEWS

A Survey of the Past and Present of Electro-therapeutics. (Editorial)
Am. J. Electroth. & Radiol. 62:346-347. Sept. 1924.

THE first static electric current, discovered and demonstrated by Dr. William J. Morton in New York in 1831, marked the introduction of the high potential currents to the medical profession. Near the end of the nineteenth century the discovery of the x ray led to the demand for more powerful generators—coils and static-machines. X ray, and later radium, enriched the field of possible medical cures as had few other discoveries during the past ages. "The treatment of inflammatory conditions, infectious and otherwise, by physical measures has been a revelation to those who have become familiar with the methods and their indications. Treatment of lesions of the skin has been revolutionized by the use of x ray and other forms of radiant energy. The cancer problem has been greatly clarified by the employment of the x rays and radium, with or without surgical coöperation, and by desiccation, endothermy, and the electrolytic method of Dr. G. Betton Massey. In gynecology, the treatment of fibroid tumors with the x ray

and radium, and the treatment of endometritis, dysmenorrhea, subinvolution, and vaginismus, with the x ray and electric modalities, has marked an advance in methods that assures more certain and more permanent relief than the methods long in vogue."

Principles of Radium Therapy. SINCLAIR TOUSEY, A. M., M. D., New York. Am. J. Electroth. & Radiol. 62:333-337. Sept. 1924.

AS to the action of radium, when first extracted from the ore, it has very little radio-activity, but if the radium is kept in a sealed container retaining the emanation, a maximum radio-activity is reached in about a month. From that time on the radium generates fresh emanation fast enough to almost counteract the loss of activity in the old.

Local application of radium has an effect which varies with the dose and quality of the radium applied. The dose is the quantity of radium or emanation multiplied by the number of hours, being designated as so many milligram hours or so many millicurie hours. The quantity of radiation applied varies inversely as the square of the distance and the thick-

ness and density of the filter. Its effect is increased about fivefold by imbedding the radium or emanation in the tissues. Filtration is used to regulate quality of the radiation.

The effect of local applications of radium depend upon the action of its three rays. (1) Little is known about the alpha rays for these rays are suppressed by any container in which the emanation is supplied. Alpha rays applied from thorium X, produce an erythema similar to that produced by beta rays. (2) Beta rays are applied with only a small percentage of gamma rays by the use of any of the ordinary containers of radium or emanation. Applying a glass tube $\frac{1}{2}$ inch long containing 10 mgm. of radium or 10 millicuries of emanation, for five minutes the primary action interpreted by the patient is variable, but the redness produced is constant and lasts two or three weeks. This is the ideal treatment for a painful fissure or ulcer and the pain and tenderness cease the day of application. Practically no filter is used, but it is best to prevent contact with the patient by the thin transparent water-proof gelatine. The neighboring skin should be protected by sheet lead one-twelfth inch thick.

This treatment is also used for the parchment-like black keratose of the elderly, and the very superficial flat moles, usually hairy or pigmented. A larger dose, 20 millicuries unfiltered, is used for fleshy or warty moles and for many epitheliomata. (3) Gamma rays form such a small percentage of the radiation from the radium that a considerable quantity of the latter must be applied and for a considerable time. A suitable dose of gamma rays would be accompanied by a great overdose of the beta rays were it not for the fact that the beta, and less penetrating rays are reduced by the filter which allows the gamma, and more penetrating rays to act. The effect of gamma rays depends upon the amount absorbed, and with the proper details all tissues to be treated receive equal radiation. Tissues arrest and absorb only a small percentage of the rays, hence a large number of millicurie hours is applied in certain cases. A common therapeutic dose of gamma rays is 50 millicuries filtered by a 0.4 mm. steel, 1 mm. brass, and 3 mm. felt. This is applied for six hours over a surface of 1 square inch for the treatment of a cancer. On the principle of the square of the distance, the intensity at the rear surface would be only one-fourth that at the front. The effect may be multiplied by cross fire. Enlarged and infected tonsils are treated by a twelve hour application of an amount of radium suited to that particular case under treatment. A special effect is produced in the case of fibroid of the uterus. Radium is usually combined with x ray in this treatment and the dose so arranged as to directly affect the tumor cells and destroy the functional activities of the ovaries, bringing about an artificial menopause. The application of radium to cases of cervical catarrh and menorrhagia must be a dose sufficient to impair the reproductive function. An example of the alterative effect of filtered radium rays is in the treatment of hypertrophy and hyperactivity of the thyroid gland in exophthalmic goitre. As much of the gland as desired can be changed from glandular to fibrous tissue with a corresponding regulation of internal secretion.

Ultraviolet Light. FRANK HANCOCK, M. D. Virginia Med. Monthly, 289-292, August, 1924.

THE physical nature and biological effect of the ultraviolet rays are discussed and reports of various cases are submitted. An experiment described in the literature is recounted in which several oranges were x rayed and certain others were given ultraviolet radiations. Afterwards all were exposed to poliofiltrates and to tuberculosis. The oranges which had been x rayed developed these diseases, the ones which had received ultraviolet radiation did not show any effects.

Report of Committee on Direct Continuous Current. FRANK B. GRANGER, M. D. Am. J. Electroth. & Radiol. 42:301-307, August, 1924.

THIS report was given at the 33rd Annual Meeting of the American Electrotherapeutic Association. The author reports progress in the use of progressive galvanism of La Picque when used to treat paralyzed muscles. It is said that the Boston City Hospital is soon to install such an apparatus and to test out its value in infantile paralysis and in paralyzed extensors associated with musculospiral nerve degeneration. The author says that much is being done to place the action of the galvanic current on a rational and scientific basis and that within a few years he thinks its *modus operandi* can be spoken of with authority.

Indications for Radium and Other Methods of Treatment in Carcinoma. WILLIAM H. SCHMIDT, M. D., Philadelphia, Penn., Am. J. Roentgenol., 12:219-230., Sept., 1924.

THE ideal treatment of cancer requires (1) an accurate study as to the location, type, and development of each individual case and, (2) an intimate knowledge of the various means that can be used which have been proven valuable in this disease. In the development of such a plan three things require careful consideration: (1) the patient, (2) the tumor, and (3) the means by which we can eradicate the tumor and restore the patient to health.

The patient should have a careful history taken, both family and personal, and a particularly accurate clinical history of the growth. This should be followed by a thorough physical examination and a complete laboratory examination of the blood

and urine. A careful search must be made for any possible metastasis, including roentgen ray examination of any suspected area, such as the chest or bones. The patient should be subjected to as little physical and mental strain as possible.

Tumors, which to all appearances are macroscopically alike, are found on microscopical study to be composed of cells in widely different stages of differentiation. Embryonal tumors are much more vulnerable and succumb to a much smaller dose of radiation than the tumors composed of highly differentiated cells; and it is readily apparent that the greater the difference of the tumor cells from the normal adult cell the more effective will be the radiation. In order to intelligently apply the treatment the tumor cells must first be recognized histologically.

Having determined the type of neoplasm with which we are dealing the next problem is to select the method applicable to the individual tumor. There are four means of attacking carcinoma, i. e., surgery, radium, roentgen radiation, the electrothermic method, and combined treatment. Each method has its own special indication and use, and frequently one must be made to supplement the other. (1) Surgery has been the method of choice for years, and has by no means been supplanted by the newer method. Surgery has its important uses and when combined with one or more of the other methods its use is very greatly extended. (2) With radium, the more embryonal the cells, the more effective the radium treatment will be. Radium is the method of choice in carcinoma of the cervix and has been proven particularly useful in accessible lymphatic tissue, carcinoma of the breast (aided by roentgen radiation), carcinoma of the prostate and bladder after surgical exposure, recurrent glioma of the orbit, carcinoma of the tonsil followed by external radiation, and carcinoma of larynx and vocal cords. (3) In contradistinction to radium, roentgen radiation should be employed when we wish to obtain a widespread effect instead of a concentrated effect. Its greatest use is as an adjunct to other treatments. "Malignant glands should receive roentgen radiation either with or without the aid of buried radium element depending on conditions. The glandular area in

carcinoma of the cervix, rectum, bladder and prostate must also receive deep roentgen therapy. A deep seated and inaccessible growth which is not associated with vital glandular structure, such as the adrenal and pancreas, should be treated with deep penetrating roentgen radiation. Metastasis to the lungs and long bones yields most readily to roentgen therapy. Sarcoma because of its size and rapid metastasis is best treated with roentgen radiation and, depending on its type, usually responds very well. Unfortunately, metastasis is usually wide spread and local success is frequently nullified by the dissemination of the disease to the blood." (4) In the author's experience practically every case of basal cell epithelioma on the face and extremities is treated by the electrothermic method as a matter of choice. The growth is destroyed and curreted away under local anaesthesia. Healing takes place rapidly and any recurrence which appears within a week or ten days, can readily be destroyed by a second application. The electrothermic method has also been used in the destruction of indolent slough resulting from radium which persists and shows slight tendency to clear up. (5) The use of combined methods utilizing one to supplement the other, has proven effective in eradicating the disease more thoroughly and permanently with less damage to the general physical condition of the patient.

X Ray Treatment of Gynecological Lesions. J. G. WILLIAMS, M. D., Lond Island Med. Journ., 18:262-265. July, 1924.

GYNECOLOGICAL conditions in which the x ray treatments are indicated may be divided into three classes: (1) Benign tumors of the skin in the region of the vulva which are found in the skin of other parts of the body. Of these, furunculosis and pruritis are the most common. Furunculosis usually responds to filtered rays of moderate voltage. A single application is generally sufficient to cause a rapid resolution of the furuncles that may be present and prevent further recurrence. Pruritis vulvae usually respond to fractional doses of unfiltered rays administered weekly, but one should avoid causing reaction to the skin: (2) Benign tumors of the uterus that respond to x ray treatment are: (a) fibroid

tumors of the uterus, except the pedunculated submucous type, or these showing degeneration; (b) functional menorrhagia or metrorrhagia of adolescence; (c) menorrhagia or metrorrhagia without evidence of pathology and most commonly observed in the fourth decade. Some of the contra-indications for this treatment are infection, active or latent, in the pelvis. An old quiescent infection may be converted into an active process by radiation therapy. When there is some complicating lesion requiring surgery for relief, this form of treatment should be used only as an adjuvant, as for example, to check hemorrhage. The technique used consisted in giving the treatment through a single large portal and using $\frac{1}{4}$ mm. copper and 1 mm. of aluminum as filter. With a distance of fifteen inches the time required for one treatment is one hour. In patients over forty, two hours of this treatment given will induce menopause: (3) Malignant disease of the female generative organs, particularly the external genitals, when operable should be removed surgically and given x ray or radium therapy as a prophylactic against recurrence. In operable cases, x ray or radium therapy is also indicated. Carcinoma of the fundus of the uterus is best treated by surgery, but in inoperable cases radium is indicated with later high voltage x ray treatment. In carcinoma of the cervix uteri primary results from radium therapy have been good. In cases in which the growth has extended into the surrounding structures, it is necessary to supplement the radium therapy with high voltage x ray therapy to influence disease in the parametrium. Malignant disease of the ovary is a surgical condition. In cases not amenable to surgery because of the risk involved or because of the extent of the disease, high voltage x ray therapy may make the patient more comfortable and prolong her life.

Radium Treatment of Cancer of the Cervix. CLYDE O. DONALDSON, M. D., and GEORGE E. KNAPPENBERGER, M. D., J. Oklahoma M. A., 17:198-201. August, 1924.

THERE are two general methods of treatment of cancer of the cervix, operation and radiation. The choice of treatment depends upon the extent of the disease. An early local-

ized lesion is equally well treated by operation or radiation. A combination of both methods is probably the best. A border line or advanced case should be treated exclusively by radiation, occasionally electrocoagulation or cautery is advisable. Biopsy should be done in every case where the diagnosis is in doubt or where it will assist in making a prognosis. Pelvic examinations should be conducted as carefully as possible and any undue trauma avoided. Repeated examinations especially if carelessly done, may spread the disease. Radium should be applied with simple preparation of the patient without undue trauma of the lesion. Both radium and x ray treatment are both indicated in every case. The tissue reaction is as important a factor in the production of good results as the direct destructive action of the rays upon the cancer cells. The prognosis of the patient should be based upon the type and extent of the lesion, the age of the individual and his physical condition. Frankly incurable cases are practically always amendable to marked palliation of distressing symptoms.

Carcinoma of the Uterus. (Editorial) Surg., Gyn. & Obs., 39:509. October, 1924.

IN this article, Dr. W. J. Mayo asserts that radium has not proven to be an effective agent for treatment of carcinoma of the body of the uterus. Since surgical procedures have cured a high percentage of carcinoma of the body of the uterus, the reasons for using radium must be very definite. Radium should not be used in these cases with the expectation of cure. In carcinoma of the cervix it has been demonstrated, however, that when the uterus is fixed and the vagina is involved, radium is superior to the knife both for curative and palliative purposes.

In a few words of conclusion he summarizes very emphatically his views. "Radium is a powerful agent for good in the hands of an expert, but an agent for very great harm in the hands of a man without surgical experience or sound clinical judgment, who uses it indiscriminately."

X Ray Therapy—Carcinoma of the Uterus. ROBERT H. MILWEE, M. D., J. Oklahoma M. A. 17:201-203. August, 1924.

THE treatment of carcinoma of the uterus, as elsewhere, is largely a question of selecting that agent which is particularly applicable in the given case, or that with which one may secure proper radiation to a given pathological area with the least damage to the normal structures. Radium has been a more important agent in the body cavities than has x ray, until recent years, by reason of the fact that in such situations, as malignancy of the cervix and uterus, better dosage could be secured with radium than could be secured with x ray. With the development of high voltage, or short wave length x ray, x rays have assumed an important role in the treatment of internal malignancies.

X ray treatment of malignancy of the uterus, should be confined to those cases in which the cervix is involved, except as a preoperative and postoperative measure where malignancy involved the fundus only. Carcinoma of the cervix is best treated by a combination of x ray and radium, the radium being applied within the cervix and the x rays to the surrounding tissues from without. Until recently, x rays which have been used for deep seated lesions, are of comparatively longer wave length, and are produced by 100,000 volts. A more penetrating ray has been generated, recently, by employing 200,000 volts or more. The application of this new method has probably increased the efficiency of radium treatment of carcinoma of the cervix, and may contribute to the improvement of surgical statistics where it is used in connection with surgery. The type of cases in which one can best determine its efficiency by observation is in the inoperable cases.

Proper dosage has always been a much discussed question with radiation therapists. Some claim that the action of x rays upon cancer cells is a direct one, and that a particular amount of radiation should be applied to all malignant cells. Others claim that the death of malignant cells is brought about in an indirect manner, that is by the response of normal tissue to the action of the x ray. There is abundant proof, according to the author, to indicate that the malignancy is destroyed by both the direct action and the effect on the normal tissues.

"While modern therapy is a definite step forward in the treatment of

uterine malignancy, curing some, and offering palliation in most cases unobtainable by other methods of treatment, we do not believe that it definitely removes from the patient that condition which brought about the malignant growth. The observation of a large number of patients receiving the radiation therapy, and their general response to this agent, suggest that this form of therapy may lead to the discovery of the cause of the malignant growths . . . Maude Slye, of Chicago University, has shown that malignancy in mice is retarded or regresses in pregnancy. Loeb of Washington University has prevented the development of cancer in a family of cancer mice by castration. A geographical study shows that malignancy is generally more prevalent where simple and toxic goitres are most abundant. These facts well suggest that the exciting cause of cancer may be either in some way due to a disturbance of internal secretions and is probably the result of artificial living. . . . where the female lives differently from the male, we find the female has more disturbances of internal glandular secretion and more malignancy."

The X Rays and Radium in the Treatment of Fibromas. DR. FOVEAU DE COURMELLES, Paris. Am. J. Electroth. & Radiol., 62: 343-345, Sept., 1924.

THE author prefers fractional treatment for fibromas. Fractional doses are given in radiotherapy 2 milliamperes, a 20 cm. spark, fifteen to thirty minutes according to the probable age of the fibroma, from one to three treatments a week for two or three weeks, a month's rest and a repetition of same. Filtration with aluminum of 2 to 10 millimeters thickness is used according as the spark is 20 or 40 cm. The patient should always be insulated from the x rays with aluminum. The rays have essentially the same effect on the fibroma as on the ovaries; if the latter are bleeding, the rays should be directed successively to the two regions, if not they should be directed on the tumor alone. The Coolidge tube is used. The seances may be prolonged and the spark increased to 30 and 40 cm., still adhering to the 2 milliamperes of current, by using multiple portals of entry.

In radiumtherapy, success has been obtained, without vesical or rectal

perforation, by placing 2 to 3 centigrams of radium bromide on each side of the uterine cervix in the cul-de-sac for forty-eight hours and repeating it two, three or four times. Radiferous salts, in silver tubes enclosed in cotton and rubber, have been used in the treatment of uterine cancer, by the author, in 1904; and they are now being applied with success in the treatment of fibromas.

Fibroids and X Rays. M. XAVIER COLANERIE. Jour. de Med. de Paris, No. 22:160-161, May 31, 1924.

IF there are symptoms of pain, hemorrhage or enlargement after the menopause this author would advocate surgical intervention for fibroids, and would recommend no other form of treatment. In a young patient the symptoms may or may not be due to fibroid and it is a question as to what treatment is best for the individual case. This is not a question to be answered by either surgeon or radiologist alone but the answer should be arrived at by a combination of opinion, unless, as is the ideal case, the physician in attendance is a man equally well informed upon the merits of both surgery and radiotherapy in gynecology.

The Treatment of Climacteric Symptoms by X Irradiation of the Pituitary and Thyroid Glands. DR. J. BORAK, Vienna, Brit. Journ. of Radiol. 29:293-296, Aug., 1924.

THE conclusions of the author are based upon the clinical experiences derived from the observation of some 50 cases. In 37 cases the local radiation was of the hypophysis, and in 13 cases of the thyroid. In all cases the symptoms disappeared in a remarkably short time. Among the cases which responded to local hypophyseal radiation were some which had remained refractory to the thyroid treatment, and some who had among other symptoms gained weight. On the contrary, the best thyroid response came from those who had lost weight. In order to rule out the possibility of a psychological influence, heavy lead diaphragms were placed between the x-rays and the skin. This absorbed the entire radiation and no effect was obtained until the diaphragms had been removed unknown to the patient.

It is generally known that x rays have a greater affect upon abnormal cells than normal cells. Since the

x radiation of the indicated gland, restrains the function and disables the cells, and causes a disappearance of the climacteric symptoms, one concludes that at least an influencing factor for the cause of these climacteric symptoms is the hyperactivity of the hypophysis cerebri and of the thyroid. Normal tissue is much less sensitive to radiation than are morbid tissues, so that the necessary dose would be very small, about one-tenth to one twentieth of an erythema dose, it being assumed that these transient conditions are not due to pure functional excess but to real cell increase in the glands. In general, the cases improved in a few days; but if after 8 days no considerable amelioration was effected another dose was given, but more than 3 doses with 8 days interval were seldom necessary. There were no secondary effects and no disturbances of the neighboring organs. The technique is very simple. The thyroid glands are treated as is usual for Basedow's disease—with a surface dose of 4 Holzknecht units, filtered by 3 mm. aluminum, 3 doses to each gland within a week, or one dose weekly for three weeks. The technique for the radiation of the hypophysis is similar to the technique for radiography of the sella turcica, preferably choosing two small hairless fields: surface dose Holzknecht units, filtration 3 mm. zinc plus 1 mm. aluminum, secondary voltage 170 kv., 3 milliamperes, in each case one-tenth to one-twentieth erythema dose should reach the required area. The action is theoretically due to an inhibitory action on the endocrine cells.

Childbearing after Radium and X Ray Treatment. FRANK A. PEMBERTON, M. D., F. A. C. S., Boston, Mass., Surg. Gynec. & Obstetrics, 39:207, August, 1921.

RADIUM and x ray for therapeutic purposes may be used during the childbearing age to relieve uterine bleeding caused by functional derangements of the ovary. They are not used in fibromyoma cases if a myomectomy is feasible. The author disregards the uterus and endometrium since permanent changes are not produced in them if an artificial menopause is not brought on. The ovaries are the organs functionally concerned in fertility.

Radiation may cause a permanent or temporary amenorrhea or oli-

gomenorrhea. The cause of the amenorrhea is believed to be the effect of the radiation on the ovaries. Maturing graafian follicles are more susceptible to radiation than the primordial follicles. It is therefore theoretically possible to use such a dose of radiation that mature follicles may be destroyed and primordial follicles not damaged. This seems to occur clinically. If amenorrhea occurs, it is usually followed by a re-establishment of menstruation. Since ovulation and menstruation are believed to be definitely related to each other, if menstruation is present, theoretically fertility is possible. According to the author, most of the statistics that could be gathered suggest the truth of this theorization clinically.

Fertilization of a partially damaged ovum might result, theoretically, in a deformed or poorly developed child; however no one has reported the birth of a deformed child subsequent to treatment, and only a few under developed ones are found.

Radiation of a fetus during pregnancy gives quite different results. Animal experimentation has shown malformations and under development after radium and x ray treatment of eggs and fetus. There are indications that the procedure may cause abortion during the early months of pregnancy but not in the later months.

"It is evident that a patient can be treated with radium or x ray and bear normal children, subsequently" but "care should be taken not to treat pregnant women—it may cause a poorly developed or deformed child."

A New Means of Avoiding Typhoid in Roentgenographing the Kidney. LILLY POKORNY, M. D., Fortschritte a. d. Geb. d. Roentgenstrahl. 33:53-54, June, 1921.

THE usual means taken to obviate this condition are dietary and mechanical, that is, no food allowed for 24 to 48 hours, and compression is employed.

The author has found the use of animal charcoal in the proportion of one teaspoonful to half a glass of water two hours before meals is very efficacious in cases in which stereoscopy shows a large amount of gas in the colon. In most cases the desired effect will be wrought within 24 hours but in severe cases it may take 48 hours. Contra-indications are aro-

phagy, obstruction of intestinal blood vessels and stenosis of the gastro-intestinal tract.

Radiographic Findings in Double Kidneys. H. G. HAMER and H. O. MERTZ. Jour. Urology 12:215-223, Sept., 1924.

IN the opinion of the authors, "when but one of the two pelves of a double kidney is diseased, the accuracy of conclusions drawn from the character of the catheterized specimen of urine will depend upon which pelvis the urethral catheter enters. When such a catheterized specimen of urine shows evidence of disease, should both pelves be involved, local treatment must in part fail so long as the anomaly remains unrecognized. When a surgical disease of the double kidney is present, the same conditions influence its recognition and preoperative diagnosis of the anomaly often prevents confusion and accident at the time of operation. As such an anomaly is frequently missed at clinical examination, a review of the roentgenogram findings was recently made in the hope that it would aid in recognizing the anomaly, especially when but one of the two pelves is pyelographed. It was determined that certain findings were more or less constant and when present, suggest that further investigation to eliminate a double kidney was justifiable." In support of their conclusions the authors present a complete history and the subsequent findings of one of their cases, the patient having since been reexamined and operated.

Kinks of the Ureter. IRA R. SICK, Madison, Wis., Jour. Urology, 12:223-237, Sept., 1924.

KINKS of the ureters occur not infrequently and may cause attacks of severe pain over long periods of time without producing much dilatation of the pelvis or calices of the kidney. They are easily overlooked both at the time of examination and at the time of operation. For the purpose of bringing them out, it is advisable to inject a medium through the ureteral catheter, the point of which is below the kinked portion of the ureter, which will appear opaque to the x ray and fluoroscope. In cases of long standing, surgery is the treatment of choice; but nonsurgical treatment gives relief in some cases for a considerable period of time.

Calcification of the Prostate. DAVID W. MACKENZIE and MAGNUS I. SENG. Department of Urology, Royal Victoria Hosp., Montreal, Quebec, Canada. *Journ. of Urol.* 12:243-249. Sept., 1924.

DIAGNOSIS of calcification of the prostate was made by means of a routine examination which included the x ray. The roentgenographic findings of the case were unusual. The true prostate calculi shadows were classified as belonging to one of two types: (1) one in which the shadows are small and symmetrical, arranged in small groups near the midline, (2) the other, in which the shadows were packed closely together and lying symmetrically on both sides of the midline. These lay just above the symphysis and might easily have lead to a diagnosis of vesical calculi. "Here the roentgenograms shows a large, dense shadow, taking the shape, more or less, of a normal prostate, just behind the symphysis. It seems as though one were looking through the pubic bones at the calculus."

Primary Carcinoma of the Female Urethra. Report of a Case Treated by Diathermy. VINCENT J. O'CONNOR, M. D. *Jour. Urology*, 12:158-168. August, 1924.

IN this instance a very extensive urethral carcinoma was locally destroyed with subsequent complete healing of the urethral and vulval regions. Complete urinary function was retained and local symptoms were completely relieved by the procedure.

It is suggested that diathermy offers a method which is superior to any previously described in effecting the local destruction of carcinoma of the female urethra. This is especially true if one bears in mind the minimization of metastases by the complete sealing off of the surrounding tissues during the slow coagulation. The procedure is devoid of operative shock, a general anesthetic is unnecessary, postoperative discomfort is slight and even in advanced cases urinary control can be maintained.

Cancerous Ulcers of the Stomach Producing only Reflex 'Duodenal' Derangements Shown by Roentgenograms. A. GALAMBOS, M. D., *Am. J. Roentgenol.* 12:230-236. Sept., 1924.

GASTRIC functional disorders provoked as secondary reflex disturbances from various organic diseases may be sensory, secretory, or motor in character. Of these, motor disturbances is by far the most important and can easily be visualized and studied by the roentgen ray. These secondary changes, (spasms, hour-glass formation, alterations in tonus and peristalsis motility), are observed only in the stomach, not in the duodenum or in other organs.

It is for this reason that special attention is given this case of gastric disease (ulcus carcinomatosum), in which secondary changes in the function of the duodenum were observed to have been produced in a characteristic way. While these secondary changes were very marked, and offer the symptom-complex of an organic duodenum disease, the stomach, which was the primary seat of the cancerous ulcer, did not manifest any direct sign of the disease; even most of the characteristic signs seem to have had their origin in an affection of the duodenum. The case report brings up the question of the possibility of an interrelationship between other organs. "It may be possible that in some cases, duodenum or gastric ulcer produces reflex changes around the appendix, manifested by tenderness and reflex rigidity of the musculature, changes which may be corroborated by some roentgenologic findings in the appendix, etc. Many of the useless appendectomies in cases of gastric and duodenal ulcer, performed on the basis of the roentgenologic diagnosis support the assumption of a reversible interrelationship between organs."

Chronic Stenosis of the Duodenum. NADOR RATKOCZI, M. D., Budapest, Hungary. *Am. J. Roentgenol.* 12:246-251. Sept. 1924.

IN his discussion the author divides chronic duodenal stenoses into two groups; (a) persistent stenoses and (b) intermittent stenoses. In the persistent stenoses, the contrast material trickles through the duodenojejunal junction by only a thin jet and the duodenum is completely filled because of the constant supply through the pylorus. Antiperistalsis may drive the food back into the bulb or even into the stomach itself, the emptying time of the stomach may be delayed as long as six to twenty-four hours. The causes of per-

sistent stenoses are, (a) adhesions after laparotomy, (b) adhesions due to tuberculosis and peritonitis, and (c) tumors of the stomach, pancreas, etc. In the intermittent stenoses, the contrast material completely fills the duodenum to the duodenojejunal junction and abruptly stops. Strong peristaltic action of the transverse and descending portions of the duodenum forces the food back into the bulb and into the stomach, only to be returned to the duodenum by an intensified gastric peristalsis. This to-and-fro movement continues for from two to twenty minutes until the duodenojejunal junction suddenly opens and the food pours into the jejunum. The emptying time of the stomach varies with this peristaltic-antiperistaltic interplay ranging from a quarter or half an hour's time to several hours. The causes of intermittent stenoses are, (a) movable tumors, (b) pressure of the mesentery or the superior mesenteric artery, (c) reflex spasm resulting from a lesion elsewhere in the gastro-intestinal tract.

Duodenal diseases do not belong to diseases of rarity. As to the therapeutics, the roentgen examination is decisive; it has to ascertain if there is an organic lesion in question and if there exists a motor disorder, both of which justify the intervention of the surgeon.

Delusions, Illusions and Facts of the Radiographic Examination of the Gastro-Intestinal Tract. W. H. WALLACE, M. D., F. A. C. P., Long Island Med. Jour. 18:259-262. July, 1924.

THERE are two distinct types of technique that can be applied when making a gastro-intestinal examination. The American school insists that it is always possible to show on a sensitized plate, the niche or shadow that represents the ulcer or other pathology in the stomach or duodenum, and to show this shadow on enough places to make it certain that it is a definite defect and not a temporary spasm or contortion. The Continental school, led by the Germans, rely on the indirect method, taking many less plates and using the fluoroscope more; studying the reflexes, watching the behavior of the intestine with its opaque meal and arriving at a diagnosis mostly by deduction.

"My technique was, and is, the single meal one. Fluoroscope during the swallowing of the meal, note the filling of the viscus and its reaction to the presence of the meal, watch for spasm or filling defects and the filling of the cap. As soon as the cap is visualized, snap a plate, and in a couple of minutes a second one. Then take a pylorograph; four views on a single plate with five or ten second intervals depending on the apparent motility of the viscus. The patient lies down an hour when another plate is taken, and the motility shown in this plate is the key to when to take the next . . . I want to know where the head of the column is when the stomach is empty . . . Very often the motility of the stomach is no key to the motility of the small gut . . . but . . . as a general rule the twenty-four hour plate completes the series. Except in well defined cases the information gleaned from my plates and fluoroscope is not enough. I want to know the patient's history; I want the report of his physical examination and the gastric analysis; these plus my own examination give the factors on which to base an intelligent diagnosis."

In conclusion, the author stresses the importance of a clear cut knowledge of anatomy, physiology, nerve reflexes and psychoses, and this knowledge must be applied to the lights and shadows of the x ray plates, especially of the gastro-intestinal tract.

Chronic Appendicitis in Children.

CHARLES G. MIXTER, M. D. Boston, J. A. M. A., 83:967. No. 13, 1924.

THE judgments of the author are based on records of one hundred cases of children under thirteen years of age, in whom a clinical diagnosis of chronic appendicitis had been made and the appendectomy performed. No case was included in which the chronicity of the condition was not established, or in which the symptoms or operative findings suggested an acute inflammatory attack.

Chronic appendicitis is rarely found in children less than five years of age although he includes a patient in this group two and one-half years of age. The greatest number of patients was in the eighth year; and the average duration of symptoms in these cases was six months. The chief complaint in 92 per cent of the cases was abdominal pain although com-

mon accompanying systems were headache, vomiting and constipation. In the abdominal examination, tenderness in the right lower quadrant was the only sign of value; but this was entirely negative in twenty-five per cent of the cases. Rectal examination showed right-sided pelvic tenderness, but this was in each case collaborating the abdominal tenderness.

"The value of the roentgen ray examination in the diagnosis of chronic appendicitis has been questioned. Certainly, negative evidence in ruling out ureteral stone, calcareous ileocecal glands, or disease of the hip or spine, is of value. Roentgenograms of the urinary tract, the dorsal and lumbar spine, the pelvis and hips should be a routine procedure in every case. Furthermore, we believe that a careful gastro-intestinal study will frequently yield additional information of value. Retention of barium in the appendix for an extreme length of time, is suggestive of angulation, or of the interference with peristalsis by adhesions or strictures. Fixity and tenderness of the caput under the fluoroscope is perhaps the most important finding. In childhood, the barium meal passes rapidly through the small intestine, and in the normal patient has largely passed the ileocecal valve at the end of the six hour interval. In chronic and subacute appendicitis, one frequently encounters a six hour gastric residual for which spasm of the pylorus is responsible. There is frequently a marked ileac retention at this time, brought about by reflex ileocecal spasm, or, more rarely, attributable to a mechanical cause, to angulation or in the interference with peristalsis by adhesions. Though the roentgen ray evidence is not conclusive, we believe it is confirmatory and of value in the connection with the history and the physical findings."

Diverticulosis and Diverticulitis of the Colon. CHARLES D. ENFIELD, M. D., F. A. C. P., Louisville, Ky. Am. J. Roentgenol. 12:243-245. Sept., 1924.

THE entire intestinal tract is subject to diverticulosis, but the pathological pouched out areas in the intestinal wall are much more common in the large than in the small bowel. Colonic diverticulosis occurs most frequently in individuals past forty years of age, and an antecedent history of chronic constipation. The

incidence for males greatly exceeds that for females. The typical patient is rather obese, not anemic, and apparently not sick; but with a history of a pain or soreness in the left lower quadrant. These diverticula consist of a herniation of the mucosa through the muscularis, varying in numbers in the individual case from one to three or four hundred. They are most commonly found in the sigmoid and descending colon, but not infrequently in the rectum, cecum, and transverse colon. They are found most commonly at the antimesenteric border, next most frequently at the mesenteric border, and occasionally on either wall irregularly located. This condition accompanied by an inflammatory process, should be referred to as "diverticulitis."

These diverticula have been divided according to their symptomatology into three groups: (1) those which are discovered incidentally to gastro-intestinal study, undertaken with other pathology in view; (2) those which have vague symptoms referable to the lower intestinal tract, of which the most constant are left lower quadrant tenderness and occasional left lower quadrant pain of moderate severity; and (3) those cases which exhibit a symptomatology of left sided appendicitis.

The roentgen ray appearance of these cases is very characteristic; but due to the filling of these pockets with fecal matter they do not readily outline with the barium mixture. The first examination even in a case with numerous well marked diverticula may show no opaque pockets. A ragged appearance of the bowel is suggestive. Occasionally in a routine gastro-intestinal examination the 24-hour examination of the colon may show one or more small dense rounded shadows outside the bowel wall. By giving an additional amount of barium by mouth, the patient may be observed forty-eight hours after the first meal and the colon will probably show additional pockets filled. The examination may be concluded with an enema at this time. Films made twenty-four hours after the enema, or even two or three days after, will usually show the pockets still filled.

Late Diagnosis of Scurvy Occurring in Infancy. HANS WIMBERGER, M. D. Fortsch. a. d. Geb. der Roentgenstrahl. 32:17-20, June, 1924.

SKELETAL changes produced in the course of scurvy may be discovered years afterwards by means of the roentgen ray, even though the patient has clinically recovered.

Roentgen Study of the Heart in the Living Newborn. E. VOGT, M. D., Fortschritte. a. d. Geb. der Roentgenstrahl. 33:75-81, June, 1924.

ROENTGEN study of the heart in the living newborn children gives sure and useful results. In the still born and the prematurely born the heart is usually of a larger size than in the normally born child. Congenital stroma is accompanied by enlarged heart even as is hypertrophy of the thymus. Congenital goiter may recede without medical treatment and may finally disappear altogether. The chief forms of the thymus to be roentgenographically distinguished are the tuberous, the pedunculated, the columnar, and less often, the asymmetrical forms.

Estimation of Cardiac Area in Man. PAUL C. HODGES, M. D., and J. A. E. EYSTER, M. D., Madison, Wis., Am. J. Roentgenol. 12:252-265, Sept., 1924.

RECOGNITION of the importance of accurate determination of heart size in relation to cardiac disease has lead to a great work in an effort to develop roentgen ray methods as a supplement to the older methods of physical diagnosis. Two methods have been employed—the distant roentgen ray film or teleoroentgenogram, and the method of orthographic projection using only the incident ray called the orthodiagram. As a result of this work, the authors offer new tables for the estimation of the normal cardiac area in man. These are derived from the formula: Area in sq. cm. = Age $0.0204 +$ Stature $0.3668 +$ Weight 0.337 minus the constant 63.8049 . If the heart is found to be 7 sq. cm. larger than the predicted area, chances are three to one that it is actually enlarged. With 14 sq. cm. the chances of pathology are ten to one and with 21 sq. cm. forty-five to one.

Motor Significance Of Haemangioma—With the Report of a Case of Plexiform Telangiectasis of the Sciatic Nerve And Its Branches S. F. STEWART, B. S., M. D., and MONA E. BETTEN, M. D., Los

Angeles, Calif., Surg. Gynec. & Obst. 39:307. Sept., 1924.

HAEANGIOMATA are neoplastic overgrowths of blood vascular tissues—varicosities, aneurisms and redundant granulation tissues are therefore excluded. They are classified clinically and pathologically according to the size of the spaces, i. e. (1) capillary, (2) cavernous, (3) plexiform or racemose angiomata. Etiologically all evidence leads to the belief that these tumors are congenital and that the element of sex is a determining factor in their occurrence. Careful examination and observation leads to a regional predisposition. In the course of the article, special consideration is given each individual anatomical pathological condition, i. e. (1) angioma of muscles and fascia, (2) angioma of bones, (3) angioma of joints, and (4) angioma of nervous system. Case reports accompany the discussions.

As to the prognosis, "all angiomata are potentially benignly malignant, usually sparing life but always marring and sometimes disabling the victims. It appears that the prognosis under treatment is dependent somewhat upon the age at which the treatment is begun; the younger the child the more favorable the prognosis" . . . but . . . "when we consider the case here recorded we wonder if deep radiation in infancy might not have averted the amputation. If ever this condition confronts us again at a time when it has not become so advanced, we will certainly advise these measures."

Checking Hemorrhage by Means of X Ray Treatment. La Presse Medicale, No. 51:545-548, June 25, 1924.

ACCORDING to this author, it is usually an easy matter to influence the coagulability of the blood by means of x ray treatments. The splenic area is usually the one rayed to check hemorrhage but the femoral artery or the carotid may be rayed. A half erythema dose over the spleen usually is sufficient and results will be apparent in an hour and one-half in some cases. This was true in a case of chronic tubercular adenitis which had resisted all other modes of treatment. Purpura and hemoptysis are reported in the cases listed.

The technique used was sphere gap, measured between points, 25 cm.; 3.5

ma.; focus-skin distance 20 cm., filter 5 mm. Al.

The Rationale of Radiation Therapy. (Editorial) Brit. J. of Radiol. 29: 296-305, August, 1924.

THE effect of radiation on tissues, varied to some extent with the intensity and duration of the exposures of the radiations, is due to a twofold action: (1) the direct action upon the tissues which varies with the intensity of the radiation, and (2) an indirect effect induced by the actions upon the tissues and the circulating fluids in the body, particularly the blood, which, because of its ready access to observation offers an opportunity of observing the effects upon the blood cells. The action, in other words, is both local and general. In the application of this radiant action, one should never strive for a cure. "Control of disease by radiation is what should be aimed at, because if that can be accomplished and the reparative powers are equal to the strain, the cure may follow. It is obvious that if control is to be attained we must understand not only the reactions upon the morbid processes, but the effects upon the physiological activity of the organs of the body."

To illustrate the feasibility of these statements, the author cites a case of splenomedullary leukaemia to whom eleven doses of radiation was given and the variation in the blood counts recorded. In the treatment, a 120,000 voltage was used with a filtration of $\frac{1}{2}$ mm. copper and a distance about 12 inches between the anticathode and the skin. The size of the aperture in the extension tube was 15 cm. by 10 cm., and the time of exposure varied from fifteen to twenty minutes for each dose. The enlarged spleen was treated anteriorly, laterally and posteriorly. Three doses were given each week on alternate areas. The final blood picture showed a great change from the original picture. The outstanding feature was the remarkable reduction in the white cell count. Before treatment this read 379,000 per cu. mm., while after treatment it read only 3,366 per cu. mm. In place of the tremendous leukocytosis, a leukopenia had been substituted. A differential count showed practically no change in the polymorphonuclear leukocytes (58%), an increase in the lymphocytes (3.1—32.0%), but an enormous di-

minution in the myelocytic count, from 33.8 per cent to 0.9 per cent. In the earlier counts, a progressive and rapid diminution in the number of red blood cells, preceded an increase and return to the original figure. In conclusion the author stated that, "it is clear to most radiologists that the cure of carcinoma by radiation is at present beyond our reach, and that to claim cure would be to retard indefinitely the progress of radiotherapy in the treatment of cancer. To establish the proof of a definite degree of control would be a greater step forward in attack upon this intractable disease.—R. K."

Radium and Internal Medicine. ELLIS FISCHER, St. Louis, Mo. Ann. of Clin. Med., 3:245, Sept. 1921.

THE author, before discussing the therapeutic indications for the use of radium in internal medicine, gives a brief summary of the history of its discovery, its physical and chemical properties.

Radium, biologically, affects both the fixed and transitory tissues. The germinal cells are more susceptible to radium than mature cells but the more important affect is that upon the blood. Radium produces a leucocytosis when it is first exposed, a leucopenia if excessively exposed, and frequently an increase in red blood cells and hemoglobin.

The administration of radium in internal medicine can be done in any number of ways. Its salts are soluble and insoluble. The soluble salt is given by mouth or intravenously. The radium gas is soluble so it can be taken by mouth or patients can breathe it in "inhalatoriums." The gas has also been given intravenously. "The dose of the soluble radium salt is 4 to 8 micrograms daily. Intravenously, 10 to 100 micrograms are dissolved in 2 c. c. of normal salt solution and injections are given, seven to ten days apart until 300 micrograms have been given. Emanations, 1.5 to 2 mc. to the liter of water are given in daily doses of 250 c. c. By inhalation 0.005 to 0.3 microcuries per liter of air are circulated through the inhalatorium. Treatments are usually of one hour's duration. The effects of treatment are usually the same, no matter what method is used.

"Radium given by mouth is excreted mostly by the intestines, some by the kidneys. When breathed in,

it is eliminated by the lungs and partly by the urine. Gas acts much more rapidly than the element—in four hours, the others in about eight to ten days. If you wish to maintain 50 micrograms in the body, give an injection of about 50 micrograms intravenously, and after ten days give 2 micrograms by the mouth every few days."

In the body, radium is found distributed in the bones, in the liver, along the blood vessels and in the spleen, in the order named. When recovered from cancer cases, tumor tissue contains no more radium than normal tissue.

The general physiological effects depend upon the enthusiasm of the therapist and the type of patient treated. This varies as with any other drug, the most constant effect being diuresis, with sometimes a slightly laxative effect and a usual long-durated decrease in blood pressure.

Radium has been used in almost every condition but the diseases in which the author considers it of real value are the following: (1) anemia, accompanied by great increase in leukocytes and enlarged spleen, (2) splenomyelogenous leukemia, (favorable), (3) splenic irradiation with marked reduction in leukocytes, (general improvement), (4) enlarged thymus (superior to x ray), (5) lymphatic leukemias (valuable), (6) Hodgkin's disease (magical melting away), (7) toxic goiter (equal therapeutically as x ray), (8) arthritis deformans (favorable results reported), (9) chronic arthritis in which no bone change has occurred (indicated), (10) gout accompanied by high blood pressure (should be tried), (11) high blood pressure (valuable), (12) myalgia, neuralgia and neuritis (it has been used), (13) chronic suppurative processes, nephritis and diabetes (it may be used), (14) psoriasis and scleroderma (worth trying), (15) general carcinomatosis (contraindicated.)

The Effect on the Blood of Irradiation, Especially Short Wave Length Roentgen Ray Therapy. GEORGE R. MINOT, M. D., and ROY G. SPURLING, M. D., Boston Am. J. of Med. Sci. 163, No. 2, 215-241.

DESIRABLE therapeutic irradiation has long been recognized as producing slight blood alterations and excessive irradiation has been

found to produce profound changes in the hematopoietic system. The general impression has been that a profound effect on the blood, which might lead to disastrous results, would become prevalent with the administration of the new short wave length therapy. Using a high voltage apparatus, Duane type, a careful study of the effect of short wave lengths on the blood elements has been undertaken, which together with a consideration of a summary of the literature on the particular phase of the subject, aids the author to determine whether a biological reaction occurred that would be of value in indicating the safe use of the apparatus.

A study was made of the blood of forty-two cases, chiefly of cancer, before and after fifty-six roentgen ray irradiation treatments. Attention was particularly given to the observation thirty-six intensive short wave treatments, the other irradiations were milder. Cases of disease of the hematopoietic tissue were not included. The author considers the most important effect (1) of customary therapeutic doses of irradiation on the blood elements as the causation of the number of white cells, especially lymphocytosis, to decrease, so that leukopenia and lymphopenia may occur. Preceding this decrease in the white count a transient increase develops due to increment of polymorphonuclear neutrophils. Very small doses of irradiation may permit a lymphocythemia (2) When a customary therapeutic dose of short wave length roentgen rays is given, the white count reaches its lowest point about 6 days later, usually accompanied by a leukopenia (below 5,000 per cu. mm.) A decrease below normal of absolute numbers of bone marrow white cells, indicative of marrow depression, is not unusual. Leukopenia lasts on the average of nine days, but may persist for over four weeks. Should the white count remain above 5,000 per cu. mm., it often does not return to its pretreatment level for over a month. Treatment given before the number of cells have remained for some time at their original level, leukopenia of a greater degree and duration is produced. Lymphocytes have their greatest drop in the first twenty-four hours but continue to fall for about three days. These cells rise with the white cell count but are proportionally

slower. (3) The new short wave length roentgen ray therapy produces more rapid and marked and persistent blood changes than milder treatment but they are of the same character. If the treatment consists of moderate long wave exposures, it may not even cause a decrease in the white cells. (4) An eosinophilia, of often seven and as high as twenty-three per cent, is usually found two or three weeks after short wave length irradiation developing particularly after repeated exposures. (5) After irradiation, the blood contains many degenerated white cells, especially in the first three days, the number varying directly with the dosage. After short wave length therapeutic irradiations the degenerated cells often amount to twenty-five per hundred formed white cells. (6) Some increase of immature white cells may be observed after large doses of irradiation. (7) Platelets increase slightly after irradiation, combined with leukopenia they may be an indication of greater marrow depression than a decrease of only the bone-marrow white cells. (8) Important changes in the count of red blood cells and hemoglobin percentage do not occur as a result of mild or intensive therapeutic irradiation. Changes in the number of immature cells occur. (9) The clinical condition of the patient will influence the degree and duration of the blood changes after irradiation but anemia "per se" does not seem to be of any great importance. The white cells of patients whose clinical condition is similar, given the same dose in the same manner, show considerable variation. On the average, patients with a higher white count before irradiation, will develop leukopenia and marked lymphopenia less often than those with a lower count. (10) Much more important than the condition of the patient in the determination of the influence of irradiation on the blood is the size, intensity and character of the dose; larger doses produce greater blood changes than smaller ones. (11) The amount of surface area irradiated is a factor of great importance in the determination of the degree of duration of the decrease of white blood cells. The greater the surface area exposed to a given amount of irradiation, the more profound the effect on the white cells. Secondary radiation with shorter wave length and larger portals of

entry plays a rôle in the production of blood changes. (12) Depression of the activity of lymphatic tissue and bone marrow are probably undesirable states, yet may occur for even weeks after irradiation without any obvious detrimental effects. In spite of the production of leukopenia and lymphopenia, the benefits derived from irradiation appear to offset these changes. (13) Prior to irradiation particularly if one dose has been given, the blood should be examined. A white count alone will usually suffice to indicate the state of the hemopoietic organs. If 5,000 per cu. mm. or more, irradiation may be given without producing serious harm to the blood forming tissues. It is not ideal to give radiation with leukopenia present, but it may be done without disaster. With leukopenia, repetition of treatment probably becomes a more serious event. (14) Before treatment is given to a patient with leukopenia, a complete study of the formed blood element should be made for it may reveal a greater degree of marrow depression than that shown by leukopenia only, and thus induce one to decide against irradiation. In order to determine whether or not to treat a patient with a degree of leukopenia, one must decide whether the benefits of treatment will offset the disadvantages of an increased depression of the hemopoietic tissues. This latter condition may become of relatively little importance and be distinctly less harmful than permitting a lesion to go untreated.

Treatment of Hyperthyroidism by Physical Measures. WILLIAM BENHAM SNOW, M. D., Am. J. Electroth. & Radiol 42:271-282, July, 1924.

TREATMENT of hyperthyroidism must be considered with reference to the findings in the individual case. Colloid and cystic goiter cases should be turned over to the surgeon as they are essentially in his field. When the tumors of the thyroid are malignant they should have both pre-operative and postoperative x ray treatment if surgery is instituted, however x ray treatment alone is often best. Diet, foci of infection and intestinal stasis all have a bearing upon end results.

The author describes his method of using mechanical vibration, static current and x ray in hyperthyroidism.

The static current has been found to play an important role in disturbed metabolism and in conjunction with regulated habits and removal of contributing causes would be generally effective.

In comparison with surgery, the x ray should never fail to diminish the secretion of thyroxin to normal if employed by the graded small dose method. Failures from the x ray are most likely due to faulty technique or failure to control conditions of metabolism which could have been controlled by attention to the cause and its removal, or by joint use of the static current.

The Production of Persistent Alopecia in Rabbits by Roentgen Ray Radiation: A Study of the Minimal Dose Required and the Consistency of the Reaction. HARRY CLARK, Ph. D. and ERNEST STRUM, J. of Exp. Med. 40:517-521.

THE authors present through this paper a detailed study of a single series of fourteen rabbits treated on the abdomen with soft rays. The animals were carefully selected for reasonable uniformity of weight, absence of pigmentation on the abdomen, general health, and particularly for freedom from nose disease. For the radiation, a standard broad-focus Coolidge tube was operated on 60 cycle current, the inverse part of which is suppressed by two kenotrons—one at either terminal of the transformer secondary. The current was kept constant by a modified Victor-Kearsley stabilizer. The milliammeter is connected between the halves of the transformer secondary, at which point the secondary is grounded. In the experiment described in this paper, the tube was operated at 30 kilovolts (peak) and 22 milliamperes, at a target distance of about 27 cm. The treatments were given through apertures in a shield of lead-filled sheet rubber. This shield, 40 cm. square, was 1.5 mm. thick except in the middle, where a rectangular portion 15 by 18 cm. was built up to a thickness of 3 mm. Seven areas on the abdomen of each of these fourteen rabbits were exposed to soft roentgen radiation of constant quality in doses varying in the region of the value critical for the production of persistent alopecia, by regular steps of about 4 per cent. Without exception the critical dose was found to lie between two such

values, the upper limit being represented by exposures on eight of the animals and the lower on ten of them. With certain reservations, the critical dose corresponds to the production of 2.04×10^{15} ions of either sign for each gram of tissue.

Treatment of Foreign Bodies in the Soft Tissues. . . . E. L. ELIASON, A. B., M. D., Sc. D., F. A. C. S., Surgeon to the Univ. of Penn. and to the Howard Hospitals. The Thera. Gaz. 43:609. Sept. 15, 1924.

FOREIGN bodies, such as shrapnel, bullets, pieces of steel, needles, splints, etc., embedded in the soft tissues, are difficult to remove without the proper preparation and preliminary examination. The improper handling of these cases occurs all too infrequently by the family physician or intern in the receiving or accident wards of the hospitals. These cases are so universally bungled that the author has undertaken to find the cause, and has given a detailed description of the technique for the conduct of these cases.

On appearing for treatment, the patient, whether there is a wound of a former attempt at removal or simply the faint entrance puncture, is asked to indicate the point of entrance. The head of a pin is placed on the skin at this point and a strip of adhesive plaster used to fasten it. A wooden splint is now applied, if necessary, to demobilize the part and x ray views are taken anteroposteriorly and laterally. With the x ray films at hand the patient is given an anæsthetic (general being the preferable one to use) and with the part bloodless, behind a tourniquet, if possible, the incision is planned, guided as to the position and depth by observing the relation of the pin marker to the buried foreign body. Should success still elude and a fluoroscope is available, it should be used.

Treatment of Local Infection. (Editorial.) Am. J. Electroth. & Radiol. 42:318-319, August, 1924.

THE control and cure of various types of infection is accomplished by one of three methods (1) destruction of germs in situ by chemical or other physical agents; (2) augmenting the body's local resistance by inducing a local persistent hyperemia by the use of diathermy and radiant light and heat or by

locally sterilizing the germs in situ by these methods; (3) by the employment of antitoxin or antibodies to terminate germ development.

Persistent exposures to radiant light and heat from incandescent source are capable of destroying the germs of erysipelas and gonorrhea when applied with the proper degree of intensity directly to the germs in situ. Ultraviolet rays destroy all bacteria with which they come in contact under brief periods of exposure.

Death from a local pyogenic infection often occurs when it could have been prevented had the surgeon or physician used an early application of heat from either of the sources just mentioned. When the infection has proceeded farther and there is already a collection of pus in subcutaneous tissues, no cure should be expected from the simple evacuation of pus and the application of wet dressings nor in the injection of antibodies always successful.

The author advocates local administration of dry hot air on an affected member, wrapped in Turkish towel, with a temperature of 300 to 500 F. to arrest cases before pus has formed, and after the evacuation of pus in more advanced cases before the infection reaches the trunk. When infection has involved the lymphatics of the trunk hot air body administration offers a greater hope than does any other method.

Treatment of Cancer of the Tongue by Radium and X Ray. RENE WEILL, M. D., Jour. de Med. de Paris, No. 21, May 24, 1924.

RADIOTHERAPY is far superior to surgery in the treatment of cancer of the tongue. Surgery in this lesion is a barbarous form of treatment and causes untold suffering to the patient. The author treats the primary lesion by radium and treats the ganglia of the neck either by radium or by deep x ray therapy. The technique favored today is to use irradiation of feeble intensity repeating the treatment in the neighborhood of from eight to ten days. Heavy doses are not productive of good results. It is frequently necessary that the dose be repeated at the site of the lesion using needles thickly massed. The treatment of course must be an uninterrupted one. The healthy tissues should be properly protected by lead or by some special apparatus for such a purpose.

The Future Relations of the Medical and Dental Professions. BYRON C. DARLING, M. D., Am. J. Roentgenol. 12:67-70, July, 1924.

IT is desirable that a standard procedure be worked out to make the relations of the general practitioner, the roentgenologist and the dentist as harmonious and as efficient as possible in the interest of both profession and public. Actual dental practice is moving toward this coöperation and medical and dental societies should appoint committees to consider the problem and to establish coöperation and a standard practice.

Electricity in Dermatology. ERNEST DWIGHT CHIPMAN, M. D. San Francisco, Calif. J. A. M. A. 83: 971. No. 13, 1924.

ELECTRICITY plays a major role in the treatment of skin diseases. The principal forms of electricity used in dermatology are the galvanic current, roentgen rays, ultraviolet rays, and the high frequency current. (1) The galvanic current, in its direct and indirect applications, is of capital importance. Probably its full measure of usefulness has not yet been attained. (2) The roentgen ray, in proper hands is the most valuable therapeutic agent in dermatology. It has been used in the treatment of disease for more than two decades with remarkable success; but in this discussion the point emphasized pertaining roentgen ray therapy is the need for proper relationship between the action of the agent we employ and the pathology of the condition we are treating. (3) Ultraviolet light is useful in a limited number of dermatoses, and holds promise for the future. The Alpine lamp is of service only in the superficial type of lesion. In parapsoriasis, it has been remarkably effective; in psoriasis, it has occasionally helped; in certain squamous eczemas, it has given satisfaction; but in pityriasis rosea, it has been of distinct service. The Kromayer lamp has shown good results with tuberculosis of the skin, lupus erythematosus of the chronic discoid type, port wine marks, angioma serpiginosum and the thickened patches of eczema, psoriasis, and lichen. With the exception of lupus erythematosus, angioma serpiginosum and port wine marks, it is probable that as good or better results may be obtained with the roentgen ray. (4) The use of the high

frequency current with glass electrodes is declining, for the reason that nothing is accomplished thereby that is more easily or expeditiously affected by other methods. In selected cases, treatment by fulguration is unquestionably of value but in most cases the same results seem to be obtainable with less pain and more certainty with the use of the galvanocautery and the roentgen ray.

The Status of Radiation Therapy in Laryngeal Cancer. (Editorial), Am. J. Roentgenol. 12:247-268, September, 1924.

IN this article, Dr. H. K. Pancoast calls particular attention to the consensus of opinion, elaborated at the recent meeting of the American Radium Society, that the treatment of laryngeal carcinoma by direct radium application had proved to be an unsuccessful procedure and gave no promise of becoming otherwise in the future.

Bismuth For Lung Mapping. (Editorial), Brit. Med. Jour. 33:19:243, Aug. 9, 1924.

THE insufflation of bismuth in the form of powder was devised by Dr. Chevalier Jackson, to examine any particular part of the tracheo-bronchial tree in a patient suspected of bronchiectasis, lung abscess, or any penetrating body. The first step consists in introducing a bronchoscope through the mouth of the anaesthetized patient to localize the affected area. A long metal tube charged with dry powdered bismuth, preferably in the form of subcarbonate, is introduced through the bronchoscope. Compression of a rubber bulb on the proximal end of the insufflator discharges the powder against the walls of the bronchi and bronchioles, making visible even the fine ramifications of the air tubes and demonstrating any dilatations or cavities in radiograms taken in the anteroposterior and lateral planes. Stereoscopic views will give opportunity for an exact determination of the position of a fragment lying either within or outside of an air tube. This method of mapping has the advantage of being carried out under visual guidance and is limited to the particular area of the lung that is suspected of pathological changes. Bismuth has no ill effects when insufflated into the lungs and is described as being beneficial to infected areas.

Illustrative Cases and Symptomatology of Pulmonary Anthrax. DR. KUECHEMANN, Fortsch. a. d. Geb. der Roentgenstrahl. 32:23-27, June 1924.

THERE is no typical roentgen picture of pulmonary anthrax and its differential diagnosis is very difficult when there are tuberculous changes present in the hila.

The Clinical and Roentgen Diagnosis of Pulmonary Infarct. GERD KOHLMANN, M. D., Fortsch. a. d. Geb. der Roentgenstrahl. 32:1-20, June, 1924.

THE definite clinical diagnosis of a pulmonary infarct is very difficult and at times is impossible. The roentgen picture of a pulmonary infarct is very clear, particularly of the so-called hemorrhagic infarct and especially if centrally located and in an early stage before congestion has become widespread.

In a hemorrhagic infarct, the form will be triangular, circular or ovoid according as the lesion is located. The latter two are more frequent than the former. The engorged infarct shows only the rounded form, is more apt to lie sideways and is less sharply outlined than the commoner purely embolic outstanding hemorrhagic one.

Roentgen examination will make the main points clear and will usually give the precise location. According to the author's experience it is mostly the right side and more frequently the lower part of the lung in which the infarct appears. It seems to have a predilection for the interlobular space between the right upper and middle lobes.

Most cases occur in women. In the author's series the average age was 45 years.

The Use of Radium in Cataract. ALBERT B. MCKEE, M. D., and WILBER F. SWETT, M. D., San Francisco, Calif. Amer. Jour. of Ophth. 7:587, Aug., 1924.

THIS report from the Division of Ophthalmology, Stanford University Medical College, made in connection with the Department of Radiology, is based on a series of twenty-five cases and collateral reading. The method of application is given in detail. It is the opinion of the authors that (1) the use of radium as a therapeutic agent in the treatment of cataract has very little value, (2)

the application of radium under known dosage according to the described technique is harmless and the effects practically nil, except for occasional photophobia, erythema, and irritability; (3) a developed cataract cannot be made to clear; (4) there was no apparent diminution of lenticular opacities, nor evidence of selective action of the lens; (5) the application of radium does not interfere with a subsequent operation should one be indicated.

Treatment of Carcinoma of the Conjunctiva With Radium. FREDERICK M. JOHNSON, M. D., New York City. Amer. Jour. of Ophth. 7:589, Aug., 1924.

THE method presented in this article is to be compared with the operative treatment so commonly used. A series of case reports with treatment and comments follows a discussion of the clinical and microscopic diagnosis and the etiological factors. The summary of the author's deductions states that epidermoid carcinoma of the conjunctiva is a local disease, restrained in its growth by the fibrous outer layer of the eyeball. As a rule surgery fails to cure but rather assists the local and regional spread of the disease. Radium therapy gives promise to being a curative agent in cases not involving intrinsic ocular structures. A combination of the two is indicated when perforation has occurred. In radium treatment, using the unfiltered bulb, none of the cases developed lens opacities. Evidence is accumulating which makes it appear that heavily filtered radiation may produce opacities of the lens.

Findings in Roentgen Examination of the Temporal Bone in Diseases of the Ear. ERNST G. MAYER, M. D., Fortschritte, a. d. Geb. d. Roentgenstrahl. 33:39-53, June, 1924.

THE author has found that x ray examination yields much valuable information in the diagnosis, prognosis and treatment of aural disease. He outlines his technique in minute detail illustrated by many diagrams, and he discusses the interpretation of plates in the diagnosis of otitis media, tuberculosis, mastoid disease, tumor, exostoses and atresia.

Direct Leverage in the Reduction of Certain Fractures. JAMES E. M. THOMSON, A. B., M. D., F. A. C. S.,

ABSTRACTS AND REVIEWS

Lincoln, Neb. Surg. Gynec. & Obst. 39:356, Sept., 1924.

THE author discusses leverage and the use of levers in the reduction of certain types of fractures, particularly those of the clavicle, humerus, radius, and ulna (one or both bones) femur, and in fractures about the ankle and the metatarsals. He qualifies its use by saying that leverage should not be used except after a reasonable effort at manual manipulation has failed. Under the guidance of the fluoroscope, a small instrument is pushed between the fractured ends and the fragments levered into position. When this work is done under fluoroscopic observation, there is a minimal amount of trauma and also the least possibility of infection, but in fractures of the femur and long bones, where fixed traction must be maintained on a fracture table, the fluoroscope is not practical.

The Rational Treatment of Sprains and Ankyloses. WILLIAM MARTIN, M. D., Atlantic City. Am. J. Electrath. & Radiol. 62:340-342, Sept., 1924.

IN the acute sprain, if rupture of the ligaments, fracture of the processes or other more serious damages are eliminated, a rapid recovery can be expected from the static wave current followed by indirect static sparks applied all over the joint. "The mechanical effect of the wave current is to contract and relax the tissues synchronously with the current jump across the spark gap, thus expressing the soft exudate out of the tissues and eliminating it through the natural channels. . . After a twenty or thirty minute treatment with this current, we follow with the sparks, which also make contractions of the tissues, but in a much quicker manner, thus affecting the deeper structures, removing muscle spasm and nerve irritation. If such treatment is given at once after the injury, two or three treatments will usually suffice to place the joint in a normal state. . . If the joint is strapped, the strap must be removed before treating the joint the next time, as the electrodes must be applied to the bare skin."

Chronic sprains do not yield so readily to treatment. Some will yield gradually to the above treatment after two or three weeks, while other cases need some active hyperemic therapy in addition.

In ankyloses, diathermy plays a star rôle. An active hyperemia is secured with the hope of restoring the synovial fluid. Following this, the static wave current is used for its mechanical effects, and the lessening of the swelling and a gradual reestablishment of motion is noted with the progress of the treatments. Sparks follow as in sprains; and in the smaller joints, such as the fingers, mechanical vibration plays an important part.

Osteopsathyrosis. (Osteogenesis Imperfecta). CLIFTON R. SCOTT, M. D., Yale Univ. Am. J. Roentgenol. 12:263-242, Sept., 1924.

OSTEOPSATHYROSIS is defined by the author as a rare systemic disease of the bones, probably congenital in origin, characterized by a deficient and imperfect bone development associated with multiple spontaneous fractures. A great deal of confusion regarding its classification, etiology, and pathogenesis has existed; but the roentgenographic appearance of the bones is so characteristic and typical that it cannot be confused with any other disease. The author quotes Locke's summary as follows: (1) A high degree of osteopor-

osis uniformly affecting the entire skeleton, the variations in density giving a mottled appearance; (2) marked deformity of the long bones of the extremities usually of an angular type and due to fractures, rarely also some actual bowing; (3) apparent normal size and shape of bones except as altered by callus formation and fractures; (4) often excessive callus formation with variable degree of calcification. A transverse area of decalcification is often seen at the point of a previous fracture; (5) the epiphyseal line is straight, cartilage very thin; (6) a very faint shadow is given by all the bones, frequently scarcely more dense than the surrounding soft parts; (7) the cortex is irregular, thin and deficient in lime salts; (8) the spongiosa of both epiphyses and diaphyses is extremely faint with entire absence of all normal markings; (9) the medullary cavity is very irregular in outline and appears dilated. The treatment suggested is very similar to that applied to rickets. The records of metabolic studies show that the calcium retention is very low and that the administration of cod liver oil favorably influences this calcium deficit. Extreme care in the prevention and after treatment of fractures is essential.

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